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# Evaluation of Additives to Eliminate Free Water from Aviation Fuel Light Obscuration Particle Counts

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**November 2015**

U.S. Army Tank Automotive Research,
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# U.S. Army Tank Automotive Research Development and Engineering Center

Warren, Michigan 48397-5000


## Evaluation of Additives to Eliminate Free Water from Aviation Fuel Light Obscuration Particle Counts


**Joel Schmitigal**
**Force Projection Technology**




**Standard Form 298 (Rev. 8/98)**

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## Introduction

Fuel quality assurance is accomplished by conducting periodic fuel sampling for the condition monitoring of aviation fuel by detecting, measuring, and reporting the levels of contaminants in the fuel. The currently accepted methods for measuring particulate and free water contamination of fuel supplies include:

- ASTM D 2276 - Standard Test Method for Particulate Contaminant in Aviation Fuel by Line Sampling
- ASTM D 3240 – Standard Test Method for Undissolved Water in Aviation Turbine Fuels
- ASTM D 4176 – Standard Test Method for Free Water and Particulate Contamination in Distillate Fuels (Visual Inspection Procedures)

Current standards, such as MIL-STD-3004, Department of Defense Standard Practice for Quality Assurance/Surveillance for Fuels, Lubricants, and Related Products and Field Manual No. 10-67-2, Department of the Army Manual for Petroleum Laboratory Testing and Operations, specifies limits for free water and particulate matter in aviation fuels. Specifically, free water contamination in jet fuel cannot exceed 10 parts per million (ppm) (1) and particulate matter contamination cannot exceed 2.0 mg/L for Intra-Governmental transfer receipts and 1.0 mg/L on issue to aircraft, or up to 10 mg/L for product used as a diesel product for ground use (1). Free water contamination (droplets) may appear as fine droplets or slugs of water in the fuel systems. The particulate matter found in field fuel systems varies in shape and is commonly found in the 5 to 40 micron size range. Common particulate matter includes silica, rust, metal shavings, fibrous materials, coatings material including paint, elastomeric materials, hydrocarbon/oxidation materials, and any other solid matter. At a minimum free water and particulate by color (as specified in the appendix of ASTM D2276) are checked daily, while filter effectiveness is checked every 30 days by gravimetric analysis (ASTM D2276).

The U.S. Army maintains the mission of providing quality fuel to all U.S. and Allied troops in tactical environments (2) (3). Presently, requirements as outlined require a dedicated group of specifically trained fuels personnel to perform several tests per day per installation, looking for traces of sediment and water in the fuel (1) (4).

The current methods have several drawbacks including operator subjectivity, lack of detailed analysis, limitations in providing reliable data, and the turn-around time needed to get the test results. For these reasons the Army has been actively working to develop new methods for monitoring fuel contamination (6) (7).

The U.S. Army Tank Automotive Research Development and Engineering Center (TARDEC) has been actively perusing advanced technologies to monitor aviation fuel for particulate and water contamination. The application of light obscuration particle counters for this purpose has risen to the top of available technologies in terms of performance and availability. The drawback of light obscuration particle counters has been the methods inability to differentiate between solid particulate matter and free water contamination, which can be problematic when allowing free water concentrations greater than 5 ppm. U.S. Army TARDEC has recommended utilizing 19/17/14/13 limits modified from ISO 4406:1999 for the 4μm(c)/ 6μm (c)/ 14μm (c)/ 30μm (c)

size channels (7), based around 1.0mg/L concentrations levels for the ISO 12103-1 A1 and A2 test dusts, and down to a free water presence of 5 ppm. The 19/17/14/13 particle counter limits have been recommended by the Tri-Service POL Users Group as an acceptable method for particulate matter with the stipulation (requirement) to perform follow on testing for particulate matter via ASTM D5452 and water via ASTM D3240 for product exceeding the limits. An alternate method for eliminating interference of free water effects while utilizing light obscuration particle counting is the utilization of a 2-propanol co-solvent, commonly known as Isopropyl alcohol (IPA), to dissolve the free water into the hydrocarbon phase or Resolver® additive that works by encapsulating the free water within molecular structures smaller than 500nm which makes them invisible to the particle counters.

## Evaluation

The test plan for evaluating the application of Resolver® additive and 2-propanol co-solvent's ability to eliminate free water droplets from light obscuration particle counting data involved the manufacture of contaminated fuels with varying levels of solid and free water contamination. The EI 1581 test facility at Southwest Research Institute was used to develop these fuel samples. The particulate injection was established at each set point, online and a bottle sample was then taken to establish a baseline measurement in the absence, or near absence, of free water. With the particulate injection held steady water injection was then set to the various set points for free water and verified via ASTM D3240 free water. Particle counts were taken online, and two 1L bottle samples were collected at each contamination level. Each bottle then had a particle count taken to establish its baseline, and was then additized with the co-solvent, 2-propanol (5.9% V/V) or Resolver® (2.3 % V/V) tumbled end over end for 60 seconds and particle counted to determine the ability of the additive to remove the water droplet effect on the measurment. The test matrix found in Table 1 provides the contaminate levels tested.

| | | | Free water Concentration PPM | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | 0 | 5 | 10 | 15 | 20 | 30 |
| Test Dust Concentration (mg/L) | A3 | 2.5 | x | | x | x | | x |
| | | 2 | x | | x | x | | x |
| | | 1 | x | x | x | x | x | |
| | | 0.5 | x | | x | x | | x |
| | | 0.25 | x | | x | x | | x |
| | A2 | 2.5 | x | | x | x | | x |
| | | 2 | x | | x | x | | x |
| | | 1 | x | | x | x | | x |
| | | 0.5 | x | x | x | x | | |
| | | 0.25 | x | | x | x | | x |
| | A1 | 2.5 | x | | x | x | | x |
| | | 2 | x | | x | x | | x |
| | | 1 | x | x | x | x | | |
| | | 0.5 | x | x | x | x | | |
| | | 0.25 | x | x | x | x | | |

**Table 1. Test Matrix**

## Analysis

Two 1L bottle samples were collected at each contamination level. Each bottle then had a particle count taken to establish its total contaminate particle count, and was then additized with the co-solvent, 2-propanol or Resolver® and particle counted a second time utilizing the Parker ACM20 meeting IP 564, and the Stanhope Seta AvCount meeting IP 565. To benchmark this data, ASTM D2276 gravimetric and ASTM D3240 free water data was also collected. The particle counts taken with the additive or co-solvent present were then compared to the baseline particle counts taken without free water present in the system to determine effectiveness of the additives to eliminate the water droplets from the particle count data. For the purposes of this report particle counting data will be displayed in a 4µm(c)/ 6µm (c)/ 14µm (c)/ 30µm (c) format.

Samples were collected in glass bottles, high density polyethylene, and tin plate steel F-style can, Figure 1, sample container material was found to have a significant effect on particle count measurements and will be discussed in detail within this paper. All sample bottles were cleaned with clean fuel prior to sample collection.

**Figure 1. 1 Liter Glass Bottle, 1 Liter HDPE bottle, and 1 Liter tin plate steel F-style can.**

## Glass Bottles

### *2.0 mg/L A3 Medium Test Dust*

ISO 12103-1 A3 medium test dust was distributed in the EI 1581 test rig at 2.0 mg/L. Baseline measurements were taken including: online particle counts on the ACM20 meeting IP 564 to be 4076/1420.4/66.3/1.3, a gravimetric sample was pulled and determined to be 1.8 mg/L, ASTM D3240 free water measurements were taken and determined to be 1.1 ppm via the D2 JF-WA1 reader. Two 1 liter samples; samples 1 and 2, Table 2; were pulled into the glass sample bottles, recording a particle count of 4859.8/1697.4/47.9/1.6 and 4614.7/1522.5/31.5/0.6 respectively. The samples were then doped with 2-propanol and Resolver additive and retested giving a 4734.5/1620.27/37.0/0.9 and 4495.3/1518.0/32.3/0.5 respectively. The differences between the particle counts prior to addition of the co-solvent additive and after additization are within the repeatability of the Parker ACM20 published in IP 564, and are therefore deemed to not be statistically significant.

Water injection was initiated at 5 ppm and verified via the D2 JF-WA1 reader to be 4.3 ppm, two 1 liter samples; 3 and 4, Table 2; were pulled into glass sample bottles for particle counter analysis. Particle count for these samples were recorded at 4133.6/1214.4/24.6/0.5 and 3848.1/1098.6/16.5/3.2 respectively, approaching the published repeatability for the instrument from the baseline measurements. This variation is significant because it is shows a drop in particle counts rather than an increase as should be seen with the increase in free water content in the fuel.

The water injection set point was bumped up to 15 ppm and verified via ASTM D3240 to be 14.4 ppm, online particle counts on the ACM 20 were established at 20121.0/11292.5/1122.6/13.6. Two 1 liter samples; 7 and 8, Table 2; were pulled into glass sample bottles for particle counter analysis, measuring 4301.0/1645.0/73.5/16.0 and

5686.3/1995.3/61.6/11.5 respectively. This variation from baseline is still within the published repeatability, or just exceeding it in the case of sample 8, of the instrument for the baseline measurements taken without any free water present.

It is theorized that the chemical composition of the glass bottles, being predominantly $SiO_2$ extracted the water from the fuel samples via hydrogen bonding. This absorption of the free water to the walls of the glass bottles resulted in the low particle count data being recorded.

**HDPE Bottles**

***1.0 mg/L A3 Medium Test Dust***

ISO 12103-1 A3 medium test dust was distributed in the EI 1581 test rig at 1.0 mg/L. Baseline particle counts on the ACM 20 were established at 2703.8/868.6/18.7/2.8, a gravimetric sample was pulled and determined to be 0.6 mg/L, ASTM D3240 free water measurements were taken and determined to be 1.3 ppm. Water injection was set at 15 ppm and confirmed via ASTM D3240 to be 10.0 ppm, online particle counts were recorded as 15309.1/8047.4/658.5/7.4. Two 1 liter samples; samples 2 and 1, Table 3; were pulled into high density polyethylene sample bottles for particle counter analysis. Particle counts for these samples gave an average of 8651.0/5448.0/402.2/90 and 783.7/417.1/53.8/20.4 respectively, these were very peculiar results as both bottles were from the same lot and treated identically and taken one after another from the test rig sample port, the reason for the deviation between the two sample bottles is unknown. The Resolver additive was added to sample 2 which dropped its particle count down to 2327.4/861.2/36.4/0.7, close to the baseline measurement the 2-propanol was added to sample 1 increased the particle count up to 1059.4/497.6/53.1/3.9 presumably due to the additive not fully partitioning into the fuel.

The water injection was reduced to 10 ppm and confirmed via ASTM D3240 to be 8.8 ppm, online particle count readings of 14283.8/7673.6/706.4/8.1 were recorded. Two 1 liter samples; samples 3 and 4, Table 4; were pulled into high density polyethylene sample bottles for particle counter analysis. Particle counts for these samples were recorded to be 1594.1/836.0/81.6/2.6 and 2220.0/1066.9/68.0/2.4 respectively, considerably lower the online particle counts, and lower than the baseline measurement. The 2-propanol was added to sample 3, tumbled for 1 minute and re-measured via the particle counter giving measurement of 1354.1/483.5/26.6/1.4, still within the repeatability of the method of the 4 and 30 micron channels. The Resolver additive was added to sample 4 which dropped its particle count down to 2060.7/837.4/60.4/1.9, a change still within the repeatedly of the method for the 4, 6, and 30 micron channels.

The water injection was reduced to 5 ppm and confirmed via ASTM D3240 to be 5 ppm, online particle count readings of 9173.4/4578.3/357.6/4.9 were recorded. Two 1 liter samples; samples 5 and 6, Table 5; were pulled into high density polyethylene sample bottles for particle counter analysis. Particle counts for these samples gave readings of 4161.0/2121.9/150.0/35.5 and 1254.9/539.9/29.9/9.1 respectively, again considerably lower the online particle counts and not consistent between the two bottles. The 2-propanol was added to sample 5, tumbled for 1 minute and re-measured via the particle counter giving measurement of 2480.0/871.3/38.1/8.9,

resembling the baseline measurement 2703.8/868.6/18.7/2.8. The Resolver additive was added to sample 6 raising its particle count in all four channels to 1439.4/582.8/41.6/13.1.

The water injection was then increased to 20 ppm and measured via ASTM D3240 to be 14.4 ppm, online particle count readings of 20077.4/11326.9/1229.1/17.3 were recorded. Two 1 liter samples; samples 7 and 8, Table 6; were pulled into high density polyethylene sample bottles for particle counter analysis. Particle counts for these samples were recorded to be 8799.0/5342.5/379.2/16.1 and 5585.6/3082.7/127.6/4.6 respectively, again considerably lower the online particle counts potentially due to coalescence of the water droplets within the bottle. The 2-propanol was added to sample 7, tumbled for 1 minute and re-measured via the particle counter giving measurement of 1900.1/680.1/35.3/1.2, the Resolver additive was added to sample 8 dropping its particle count to 2269.2/887.9/62.4/5.1, both of which are acceptable results seeing that the baseline measurement of 2703.8/868.6/18.7/2.8 was recorded with 1.3 ppm free water present.

### *1.0 mg/L A1 Ultrafine Test Dust*

ISO 12103-1 A1 ultrafine test dust was distributed in the EI 1581 test rig at 1.0 mg/L. Baseline particle counts on the ACM 20 were established at 5962.4/1822.4/17.5/1.2 online (7303.9/2108.6/15.3/0.7 bottle sample), a gravimetric sample was pulled and determined to be 1.15 mg/L, ASTM D3240 free water measurements were taken and determined to be 1.5 ppm. Water injection was set at 5 ppm and confirmed via ASTM D3240 to be 4.5 ppm, an online particle count was recorded as 12824.1/5773.9/281/3.5. Two 1 liter samples; samples 5 and 6, Table 7; were pulled into high density polyethylene sample bottles for particle counter analysis. Particle counts for these samples were recorded at 2432.6/858.9/56.3/10.1 and 6517.0/2148.1/61.1/1.7 respectively, again the reason for the deviation between the two bottles is unknown, and both below the baseline measurement. The 2-propanol was added to sample 5 giving another strange result in increasing the particle count up to 3437.9/1142.9/48.1/6.3 while the Resolver additive had almost a negligible change to sample 6 with the resulting particle count recording of 6531.8/2079.9/45.7/1.6. The Stanhope Seta AvCount particle counts meeting IP 565 also showed a deviation between the two samples and an increase in particle counts with additive addition as shown in Table 8.

The water injection was increased to 10 ppm and confirmed via ASTM D3240 to be 10.0 ppm, online particle count readings of 18913.1/9654.4/678.1/6.4 were recorded. Two 1 liter samples; samples 3 and 4, Table 9; were pulled into high density polyethylene sample bottles for particle counter analysis. Particle counts for these samples gave readings of 4418.1/1945.5/151.5/2.4 and 2013.7/695.3/39.2/2.6 respectively, again below the baseline measurements, and considerably lower the online particle counts. The 2-propanol was added to sample 3, tumbled for 1 minute and measured via the particle counter giving measurement of 4804.8/1720.0/60.5/2.1, still within the repeatability of the method of the 4, 6, and 30 micron channels. The Resolver additive was added to sample 4 which increased its particle count up to 3781.5/1325.0/52.1/2.4.

The water injection was increased to 15 ppm and confirmed via ASTM D3240 to be 12.4 ppm, online particle count readings of 21621.5/11475.1/904.3/9.9 were recorded. Two 1 liter samples;

samples 2 and 1, Table 11; were pulled into high density polyethylene sample bottles for particle counter analysis. Particle counts for these samples gave readings of 15965.5/8979.0/511.3/4.2 and 6168.8/3669.3/335.1/4.7 respectively, again lower than the online particle counts and with quite a bit of variation between the two sample bottles. The Resolver additive was added to sample 2 decreasing its particle count down to 6499.6/2006.5/26.2/2.3 closely in line with the baseline measurement while the 2-propanol added to sample 1, reduced the particle counter down to 3718.1/1412.7/79.6/8.1.

***0.5 mg/L A1 Ultrafine Test Dust***

The ISO 12103-1 A1 ultrafine test dust was distributed in the EI 1581 test rig at 0.5 mg/L. A baseline particle count on the ACM 20 was established at 3554.2/1028.7/9.2/0.6 online (3743.9/980.7/7.8/0.6 bottle sample), a gravimetric sample was pulled and determined to be 0.675 mg/L. The water injection set to 5 ppm and confirmed via ASTM D3240 to be 5.5 ppm, online particle count readings of 10962.9/5238.9/300.1/4.0 were recorded. Two 1 liter samples; samples 11 and 12, Table 13; were pulled into high density polyethylene sample bottles for particle counter analysis. Particle counts for these samples gave readings of 1567.1/468.9/14.5/1.5 and 1221.1/389.7/15.6/1.1 respectively, again quite a bit lower the online particle counts and lower than the baseline measurements. 2-propanol was added as a cosolvent to sample 11 which increased its particle count measurement up to 2483.3/744.6/15.7/0.4, while the Resolver additive added to sample 12 increased its particle count up to 2049.4/787.7/43.7/5.7. These particle count trends were also seen in the Stanhope Seta AvCount, IP 565, particle counts provided in Table 14.

The water injection was increased to 10 ppm and confirmed via ASTM D3240 to be 10.8 ppm, with online particle count readings of 17791.6/9449.7/711.5/5.7. One 1 liter sample; sample 20, Table 15; was pulled into high density polyethylene sample bottle for particle counter analysis. The particle count for this sample gave 3645.1/1578.6/83.6/3.5 when doped with the Resolver additive a particle count of 2927.2/973.6/29.3/1.9 was recorded, particle counts went up 540 total counts when testing on the Stanhope Seta AvCount instrument.

The water injection was increased to 15 ppm and confirmed via ASTM D3240 to be 17.6 ppm, online particle count readings of 20584.0/11276.1/935.3/9.1 were recorded. Two 1 liter samples; samples 7 and 8, Table 17; were pulled into high density polyethylene sample bottles for particle counter analysis. Particle counts for these samples gave readings of 1972.7/916.9/75.1/3.8 and 7966.4/5068.6/333.9/3.6 respectively, again lower than the online particle counts and quite a bit of variation between the two sample bottles. The 2-propanol added to sample 7 increased the 2553.4/786.6/14.9/1.0, and almost tripled when tested on the Stanhope Seta AvCount particle counter. The Resolver additive added to sample 8 decreased its particle count down to 3490.0/1164.1/29.9/1.7, with a similar decrease seen with the AvCount instrument.

***0.25 mg/L A1 Ultrafine Test Dust***

The ISO 12103-1 A1 ultrafine test dust was distributed in the EI 1581 test rig at 0.25 mg/L. Baseline particle counts on the ACM 20 were established at 2823.4/787.6/7.2/0.8 online

(633.0/190.4/1.9/0.1 HDPE bottle sample, 2850.4/661.2/4.4/0.7 glass bottle), a gravimetric sample was pulled and determined to be 0.55 mg/L. The water injection set to 5 ppm and confirmed via ASTM D3240 to be 5.2 ppm, online particle count readings of 10123.5/4914.6/292.9/3.4 were recorded. Two 1 liter samples; samples 6 and 1, Table 19; were pulled into high density polyethylene sample bottles for particle counter analysis. Particle counts for these samples gave readings of 1592.6/462.5/16.5/1.1 and 1317.6/359.9/10.9/0.4 respectively. The Resolver additive was mixed into sample 6, the 2-propanol was added to sample 1 both causing an increase in particle counts to 2390.7/833.2/27.3/0.9 and 2234.1/703.6/26.1/2.0 respectively. These particle count increases were also seen in the Stanhope Seta AvCount, IP 565, provided in Table 20.

The water injection was increased to 10 ppm and confirmed via ASTM D3240 to be 11.2 ppm, with online particle count readings of 17673.8/7570.1/757.4/8.1. Two 1 liter samples; samples 2 and 3, Table 21; were pulled into high density polyethylene sample bottles for particle counter analysis. Particle counts for these samples gave readings of 1695.6/758.6/43.6/3.7 and 1383.2/597.4/39.2/3.5 respectively. When doped with the Resolver and 2-propanol additives slight changes with decreases with the Resolver and increases were seen in the case of the 2-propanol with measurements of 1628.9/547.0/25.4/3.0 and 1956.9/748.8/20.0/1.4 respectively, with similar effects seen with the AvCount instrument, Table 22.

The water injection was increased to 15 ppm and confirmed via ASTM D3240 to be 15.2 ppm, with online particle count readings of 22296.9/12528.4/1158.9/9.7. Two 1 liter samples; samples 4 and 5, Table 23; were pulled into high density polyethylene sample bottles for particle counter analysis. Particle counts for these samples gave particle counts of 5875.8/3234.3/213.1/11.7 and 3927.3/2213.6/215.2/18.4 respectively. The Resolver additive was mixed into sample 4 and remeasured giving a reading of 2641.8/796.1/14.2/0.4 the 2-propanol co-solvent was mixed into sample 5 giving a 2588.9/896.6/18.4/0.5 particle count, both samples showing a drop in particle counts across all four channels, the AvCount 4µm measurement did increase as shown in Table 24.

All the particle count data taken utilizing the high density polyethylene containers is highly suspect indicating that sample containers of this material type should not be used for fuel samples that will be tested for particulate or free water content.

## Tin Cans

### *2.5 mg/L A3 Medium Test Dust*

Tin plate steel F-style cans were used to perform the balance of the testing performed and greatly improved the particle count data obtained for the remainder of the experiments. ISO 12103-1 A3 medium test dust was distributed in the EI 1581 test rig at 2.5 mg/L. Baseline particle counts on the ACM 20 were established at 4883.6/1692.1/86.6/2.4 online (5065.9/1745.5/65.1/1.8 bottle sample), a gravimetric sample was pulled and determined to be 1.725 mg/L. With the water injection set to 10 ppm, and confirmed via ASTM D3240 to be 8.0 ppm, online particle count readings of 16616.9/8847.9/749.5/8.5 were recorded. Two 1 liter samples; samples 17 and 21,

Table 25; were pulled into tin plate steel F-style cans for particle counter analysis. Particle counts for these samples gave readings of 9149.4/5050.0/245.0/3.4 and 8407.1/4483.3/256.9/4.2 respectively. The 2-propanol co-solvent was added to sample 17 while Resolver was added to sample 21 dropping the particle counts for the two samples down to 4745.9/1655.5/64.3/5.5 and 4575.1/1564.6/63.1/2.9 respectively which closely aligns with the 5065.9/1745.5/65.1/1.8 baseline measurement which contained 0.7 ppm free water. Similar trends were seen with testing particle counts on the AvCount instrument, Table 26.

The water injection was increased to 15 ppm and confirmed via ASTM D3240 to be 16.2 ppm, with online particle count readings of 20350.1/11330.4/1077.8/12.9. Two 1 liter samples; samples 9 and 19, Table 27; were pulled into tin plate steel F-style cans for particle counter analysis. Particle counts for these samples gave particle counts of 10450.2/6109.1/314.3/3.4 and 9683.7/5452.6/203.1/3.4 respectively. When doped with the 2-propanol and Resolver co-solvents the particle counts dropped down to 4621.3/1598.8/62.3/3.6 and 4248.6/1390.3/55.3/2.4 respectively, again falling closely in line with the baseline measurement and the results obtained from the 10 ppm test found in Table 25. Again similar effects were seen with the additives when testing was performed with the AvCount instrument, Table 28, where the data comes close to aligning with the baseline measurement and similarly close to the data obtained during the 10 ppm evaluation details provided in Table 26.

The water injection was increased to 30 ppm but confirmed via ASTM D3240 to be only 18.5 ppm, with online particle count readings increased to 30518.9/18773.3/2768.3/30.8. Two 1 liter samples; samples 5 and 10, Table 29; were pulled into tin plate steel F-style cans for particle counter analysis. Testing of these samples gave particle counts of 18522.4/12324.7/681.7/2.5 and 19792.4/13216.5/724.0/2.3 respectively. When doped with the 2-propanol and Resolver the particle counts dropped down to 4664.5/1616.4/64.4/5.1 and 3788.7/1095.0/29.0/1.7 respectively, again falling closely in line with the baseline measurement and the results obtained from the 10 ppm and 15 ppm tests found in Table 25 and Table 27. Again similar effects were seen with the additives when testing was performed with the AvCount instrument, Table 30, where the data comes close to aligning with the baseline measurement and similarly close to the data obtained during the 10 ppm and 15 ppm evaluation details provided in Table 26 and Table 28.

### *2.0 mg/L A3 Medium Test Dust*

ISO 12103-1 A3 medium test dust was distributed in the EI 1581 test rig at 2.0 mg/L. Baseline particle counts on the ACM 20 were established at 4076.0/1420.4/66.3/1.3 online (4280.1/1543.4/47.2/037 bottle sample), a gravimetric sample was pulled and determined to be 0.65 mg/L. With the water injection set to 10 ppm, and confirmed via ASTM D3240 to be 8.6 ppm, online particle count reading of 15451.1/8243.9/694.3/8.5 were recorded. Two 1 liter samples; samples 20 and 18, Table 31; were pulled into tin plate steel F-style cans for analysis. Particle counts for these samples gave readings of 13938.9/8467.9/495.1/4.4 and 8258.5/4779.7/281.4/2.4 respectively. The Resolver additive was mixed into sample 20 while the 2-propanol co-solvent was added to sample 18 dropping the particle counts for these samples down to 3827.3/1324.6/48.8/3.1 and 3921.3/1406.1/46.3/2.0 closely aligning to the

4280.1/1543.4/47.2/037 baseline measurement which was found to have 0.8 ppm free water. Similar trends were seen with testing particle counts on the AvCount instrument, Table 32.

The water injection was increased to 15 ppm and confirmed via ASTM D3240 to be 16.0 ppm, with online particle count reading of 20121.0/11292.5/1122.6/13.6. Two 1 liter samples; samples 1 and 2, Table 33; were pulled into tin plate steel F-style cans for testing, giving particle counts of 7683.5/4373.1/285.4/2.6 and 8206.3/4811.6/266.8/3.1 respectively significantly lower than the online counts perhaps due to potentially due to coalescence of the water droplets within the bottle with close to 30 minutes elapsing between then the samples were pulled from the pipeline to when they were tested. When doped with the 2-propanol and Resolver co-solvents the particle counts dropped down to 3758.4/1322.9/46.6/3.6 and 3289.9/1053.1/29.0/0.6 respectively, again falling fairly close to the baseline measurement and the results obtained from the 10 ppm test found in Table 31. Again similar effects were seen with the additives when testing was performed with the AvCount instrument, Table 34, where the data comes close to aligning with the baseline measurement and similarly close to the data obtained during the 10 ppm evaluation details provided in Table 32.

The water injection was increased to 30 ppm and confirmed via ASTM D3240 to be 26.5 ppm, with online particle count readings increasing to 30312.4/18647.4/2711.1/29.4. Two 1 liter samples; samples 5 and 10, Table 29; were pulled into tin plate steel F-style cans for particle counter analysis. Particle counts for these samples gave readings of 17233.6/11588.9/657.2/2.5 and 20123.9/13742.6/819.4/2.9 respectively. When additized with the 2-propanol and Resolver co-solvents the particle counts dropped down to 3569.7/1235.9/40.1/2.0 and 3388.3/1110.9/52.0/1.8 respectively, again falling closely to the baseline measurement and the results obtained from the 10 ppm and 15 ppm tests found in Table 31 and Table 33. Again similar effects were seen with the additives when testing was performed with the AvCount instrument, Table 36, where the data comes close to aligning with the baseline measurement and similarly close to the data obtained during the 10 ppm and 15 ppm evaluation details provided in Table 32 and Table 34.

### *0.5 mg/L A3 Medium Test Dust*

ISO 12103-1 A3 medium test dust was distributed in the EI 1581 test rig at 0.5 mg/L. Baseline particle counts on the ACM 20 were established at 890.5/304.7/11.9/0.3 online (832.4/264.0/7.4/0.2 bottle sample), a gravimetric sample were pulled and determined to be 0.275 mg/L. With the water injection set to 10 ppm, and confirmed via ASTM D3240 to be 5.8 ppm, online particle count readings of 7559.8/5154.6/250.9/1.0 was recorded. Two 1 liter samples; samples 25 and 21, Table 37; were pulled into tin plate steel F-style cans for particle counter analysis. Particle counts for these samples gave readings of 7559.8/5154.6/250.9/1.0 and 4432.0/3019.8/211.0/0.8 respectively. The Resolver additive was mixed into sample 25 while the 2-propanol co-solvent was added to sample 21 dropping the particle counts for these samples down to 904.5/295.3/8.1/0.5 and 894.1/292.5/11.1/0.4 respectively and closely aligning to the 832.4/264.0/7.4/0.2 baseline measurement which contained 0.7 ppm free water. Similar trends were seen when particle counts were taken with the AvCount instrument, Table 38.

The water injection was increased to 15 ppm and confirmed via ASTM D3240 to be 15.2 ppm, with online particle count reading of 20623.4/12118.6/1314.6/14.0. Two 1 liter samples; samples 22 and 1, Table 39; were pulled into tin plate steel F-style cans for particle counter analysis. Particle counts for these samples gave particle counts of 5570.3/3897.6/260.1/1.6 and 6348.2/4478.9/282.9/1.2 respectively again significantly lower than the online counts perhaps potentially due to coalescence of the water droplets within the bottle with close to 30 minutes elapsing between then the samples were pulled from the pipeline to when they were tested. When doped with the 2-propanol and Resolver co-solvents the particle counts dropped down to 957.1/300.2/8.9/1.0 and 719.9/229.6/7.3/0.4 respectively, again falling fairly close to the baseline measurement of 832.4/264.0/7.4/0.2 and the results obtained from the 10 ppm test found in Table 37. Again similar effects were seen with the co-solvents when testing was performed with the AvCount instrument, Table 40, where the data comes close to aligning with the baseline measurement and similarly close to the data obtained during the 10 ppm evaluation details provided in Table 38.

The water injection was increased to 30 ppm and confirmed via ASTM D3240 to be 29.0 ppm, with online particle count readings increased to 30820.4/19398.4/3078.1/35.1. Two 1 liter samples; samples 28 and 29, Table 41; were pulled into tin plate steel F-style cans for particle counter analysis. Particle counts for these samples gave particle counts of 15711.6/11360.6/668.6/2.2 and 16297.3/11654.9/594.0/1.5 respectively. When additized with the 2-propanol and Resolver additives the particle counts dropped down to 913.4/291.4/3.8/0.1 and 757.1/238.1/4.8/0.1 respectively, again falling closely to the baseline measurement and the results obtained from the 10 ppm and 15 ppm tests found in Table 37 and Table 39. Again similar effects were seen with the co-solvents when testing was performed with the AvCount instrument, Table 42, where the data comes close to aligning with the baseline measurement and similarly close to the data obtained during the 10 ppm and 15 ppm evaluation details provided in Table 38 and Table 40.

***0.25 mg/L A3 Medium Test Dust***

ISO 12103-1 A3 medium test dust was distributed in the EI 1581 test rig at 0.25 mg/L. Baseline particle counts on the ACM 20 were established at 542.1/235.4/10.5/0.3 online (411.1/248.1/22.7/1.1 bottle sample), a gravimetric sample was pulled and determined to be 0.025 mg/L. With the water injection set to 10 ppm, and confirmed via ASTM D3240 to be 6.6 ppm, online particle count readings of 13771.6/7791.8/665.1/6.1 were recorded. Two 1 liter samples; samples 24 and 27, Table 43; were pulled into tin plate steel F-style cans for evaluation. Particle counts for these samples gave readings of 10673.3/7230.4/415.0/3.2 and 4430.1/3265.7/236.0/2.9 respectively. The Resolver additive was mixed into sample 24 while the 2-propanol co-solvent was added to sample 27 dropping the particle counts for these samples down to 106.6/40.8/2.6/0.9 and 77.1/32.0/3.3/0.5 respectively whereas the baseline measurement had a particle count of 411.1/248.1/22.1/1.1 which had 0.7 ppm free water. Similar trends were seen with the AvCount instrument, Table 44.

The water injection was bumped up to 15 ppm and confirmed via ASTM D3240 to be 12.2 ppm, with online particle count reading of 18370.1/10668.9/1040.1/12.2. Two 1 liter samples;

samples 26 and 27, Table 45; were pulled into tin plate steel F-style cans for particle counter analysis. Particle counts for these samples gave particle counts of 6100.8/4376.0/185.0/0.6 and 5583.9/4049.4/175.1/0.6 respectively again significantly lower than the online counts potentially due to coalescence of the water droplets within the bottle with close to 30 minutes elapsing between then the samples were pulled from the pipeline to when they were tested. When doped with the 2-propanol and Resolver additives the particle counts dropped down to 62.6/20.9/2.1/0.2 and 83.0/29.6/2.4/0.6 respectively, again falling below the baseline measurement and as did the results obtained from the 10 ppm test found in Table 43. Again similar effects were seen with the additives when testing was performed with the AvCount instrument, Table 46, where the data comes close to aligning with the baseline measurement and similarly close to the data obtained during the 10 ppm evaluation details provided in Table 44.

The water injection was increased to 30 ppm and confirmed via ASTM D3240 to be 28.5 ppm, with online particle count readings increased to 30074.1/18735.7/2825.6/30.9. Two 1 liter samples; samples 24 and 18, Table 47; were pulled into Tin Plate Steel cans for particle counter analysis. Particle counts for these samples gave particle counts of 16719.7/12258.6/900.3/15.5 and 25470.9/17853.4/767.2/1.5 respectively. When additized with the 2-propanol and Resolver co-solvents the particle counts dropped down to 142.5/51.4/2.7/1.0 and 91.9/28.4/1.7/0.3 respectively, again falling below the baseline measurement and the results obtained from the 10 ppm and 15 ppm tests found in Table 43 and Table 45. Again similar effects were seen with the additives when testing was performed with the AvCount instrument, Table 48, where the results fell below the baseline measurement and similarly close to the data obtained during the 10 ppm and 15 ppm evaluation details provided in Table 44 and Table 46.

***2.5 mg/L A2 Fine Test Dust***

ISO 12103-1 A2 fine test dust was distributed in the EI 1581 test rig at 2.5 mg/L. Baseline particle counts on the ACM 20 were established at 7574.2/2202.2/13.9/0.9 online (7625.5/1985.3/8.1/0.3 bottle sample), a gravimetric sample was pulled and determined to be 0.925 mg/L. With the water injection set to 10 ppm, and confirmed via ASTM D3240 to be 10.2 ppm, online particle count readings of 18173.2/9091.1/724.0/8.4 were recorded. Two 1 liter samples; samples 24 and 21, Table 49; were pulled into tin cans for particle counter analysis. Particle counts for these samples gave readings of 6599.6/1828.6/72.3/1.7 and 6289.7/1646.9/38.9/0.8 respectively. The Resolver additive was mixed into sample 24 while the 2-propanol co-solvent was added to sample 21 both resulting in a higher total particle count for these samples 7612.5/1770.5/9.3/0.4 and 6723.6/1754.9/10.9/0.7 respectively all lower than the original baseline measurement which had 1.5 ppm free water. These samples did sit close to 2 hours between sampling and testing which may have resulted in the water being absorbed into the fuel or bind to the sample container. Similar trends were seen when testing particle counts with the AvCount instrument, Table 50.

The water injection was increased to 15 ppm and confirmed via ASTM D3240 to be 15.0 ppm, with online particle count reading of 21710.8/11666.7/1123.6/11.1. Two 1 liter samples; samples 22 and 25, Table 51; were pulled into tin plate steel F-style cans for particle counter analysis. Particle counts for these samples gave particle counts of 7312.4/2942.0/146.8/1.1 and

6465.3/2330.4/91.3/1.2 respectively again significantly lower than the online counts perhaps due to potentially due to coalescence of the water droplets within the bottle with close to 2 hours elapsing between then the samples were pulled from the pipeline to when they were tested. When doped with the 2-propanol and Resolver co-solvents the particle counts, particularly in the 6 micron and 14 micron channels, dropped down to 7295.9/2112.4/12.5/0.4 and 5267.4/1196.5/8.9/0.3 respectively, again falling slightly below the baseline measurement and as did the results obtained from the 10 ppm test found in Table 49. Again similar effects were seen with the additives when testing was performed with the AvCount instrument, Table 52.

The water injection was increased to 30 ppm and confirmed via ASTM D3240 to be 32.0 ppm, with online particle count readings increased to 30866.8/18838.6/2832.4/33.6. Two 1 liter samples; samples 23 and 26, Table 53; were pulled into tin plate steel F-style cans for particle counter analysis. Particle counts for these samples gave particle counts of 16981.1/11147.5/1025.1/16.6 and 17462.7/11488.1/1032.6/18.2 respectively. When additized with the 2-propanol and Resolver co-solvents the particle counts dropped down to 7525.2/2211.0/15.4/0.4 and 5953.4/1545.4/15.6/0.6 respectively, again falling below the baseline measurement for most channels and the results obtained from the 10 ppm and 15 ppm tests found in Table 49 and Table 51. Again similar effects were seen with the additives when testing was performed with the AvCount instrument, Table 54, where results fell below the baseline measurement and similarly close to the data obtained during the 10 ppm and 15 ppm evaluation details provided in Table 50 and Table 52.

### *2.0 mg/L A2 Fine Test Dust*

ISO 12103-1 A2 fine test dust was distributed in the EI 1581 test rig at 2.0 mg/L. Baseline particle counts on the ACM 20 were established at 6005.8/1454.0/46.8/2.4 online (5896.8/1377.7/27.6/0.7 bottle sample), a gravimetric sample was pulled and determined to be 1.60 mg/L. With the water injection set to 10 ppm, and confirmed via ASTM D3240 to be 9.8 ppm, online particle count readings of 16310.7/7972.3/648.1/6.1 were recorded. Two 1 liter samples; samples 18 and 20, Table 55; were pulled into tin plate steel F-style cans for particle counter testing. Particle counts for these samples gave readings of 5647.2/1606.2/93.6/2.3 and 5983.3/1826.1/84.3/1.6 respectively. The 2-propanol co-solvent was mixed into sample 18 while the Resolver additive was added to sample 20 both resulting in a slightly lower particle count for these samples 5556.1/1312.4/44.4/0.9 and 4476.4/828.0/9.7/0.3 respectively all lower than the original baseline measurement which had 1.5 ppm free water. These samples did sit close to 2 hours between sampling and testing which may have resulted in the water being absorbed into the fuel or binding to the sample container. Similar trends were seen with testing particle counts on the AvCount instrument, Table 56.

The water injection was increased to 15 ppm and confirmed via ASTM D3240 to be 14.4 ppm, with online particle count reading of 20634.4/10983.4/1085.0/13.7. Two 1 liter samples; samples 22 and 19, Table 57; were pulled into tin plate steel F-style cans for testing. Particle counts for these samples gave particle counts of 7424.1/3161.4/103.4/0.6 and 7032.9/2910.5/165.8/2.7 respectively again significantly lower than the online counts perhaps due to potentially due to absorption of water into the fuel within the bottle with 2 hours elapsing

between then the samples were pulled from the test rig to when they were tested. When doped with the Resolver co-solvents and 2-propanol additive the particle counts dropped down to 4209.7/800.6/15.2/0.6 and 5281.8/1243.4/29.6/0.9 respectively, falling slightly below the baseline measurement as did the results obtained from the 10 ppm test found in Table 55. Similar effects were seen with the additives when testing was performed with the AvCount instrument, Table 58.

The water injection was increased to 30 ppm and confirmed via ASTM D3240 to be 35.5 ppm, with the online particle count readings increasing to 29573.8/18218.3/2708.5/33.0. Two 1 liter samples; samples 20 and 23, Table 59; were pulled into tin plate steel F-style cans for particle counter analysis. Particle counts for these samples gave particularly peculiar particle counts of 13724.1/9154.7/439.4/4.3 and 7509.9/5492.3/216.5/1.2 respectively. When additized with the 2-propanol and Resolver co-solvents the particle counts dropped down unexpectedly low with additional strange particle counts of 2072.7/544.8/27.0/1.3 and 685.6/160.8/7.9/0.8 respectively. This data point is an obvious outlier and will be excluded from further statistical analysis. As expected similar effects were again seen with the additives when testing was performed with the AvCount instrument, Table 60. They drop in particle count may be attributed to an undetected problem with the particulate injection.

### *1.0 mg/L A2 Fine Test Dust*

ISO 12103-1 A2 fine test dust was distributed in the EI 1581 test rig at 1.0 mg/L. Baseline particle counts on the ACM 20 were established at 3503.0/852.5/26.5/1.0 online (4007.4/980.2/24.9/0.9 bottle sample), a gravimetric sample was pulled and determined to be 0.55 mg/L. With the water injection set to 10 ppm, and confirmed via ASTM D3240 to be 10.4 ppm, online particle count readings of 15243.7/7858.7/665.7/7.3 were recorded. Two 1 liter samples; samples 1 and 2, Table 61; were pulled into tin plate steel F-style cans for particle counter analysis. Particle counts for these samples gave readings of 7270.9/3618.5/264.9/2.8 and 5674.7/2422.9/169.6/2.2 respectively. The 2-propanol co-solvent was mixed into sample 1 while the Resolver additive was added to sample 2 reducing the particle counts for these samples to 3884.1/955.1/31.5/1.2 and 3447.4/807.5/22.6/0.9 respectively lower than the original baseline measurements which had 1.0 ppm free water. Similar trends were seen with testing on the AvCount instrument, Table 62.

The water injection was increased to 15 ppm and confirmed via ASTM D3240 to be 14.0 ppm, with online particle count reading of 20095.0/11052.8/1129.2/11.9. Two 1 liter samples; samples 3 and 4, Table 63; were pulled into tin plate steel F-style cans for particle counter analysis. Particle counts for these samples gave particle counts of 9900.7/5705.8/403.1/7.1 and 10334.5/6099.3/381.5/2.7 respectively again significantly lower than the online counts. When doped with the 2-propanol co-solvents and Resolver additive the particle counts dropped down to 3699.5/901.4/24.9/0.9 and 3288.4/765.9/21.9/0.8 respectively, falling below the baseline measurement and as did the results obtained from the 10 ppm test found in Table 61. Again similar effects were seen with the co-solvents when testing was performed with the AvCount instrument, Table 64.

The water injection was increased to 30 ppm and confirmed via ASTM D3240 to be 17.0 ppm, with online particle count readings increased to 28548.0/17129.8/2419.6/31.0. Two 1 liter samples; samples 5 and 6, Table 65; were pulled into tin plate steel F-style cans for particle counter analysis. Particle count testing for these samples gave results of 18314.5/12290.4/959.1/7.4 and 25803.7/16377.4/1221.7/11.9 respectively. When additized with the 2-propanol and Resolver co-solvents the particle counts dropped down to 3515.7/855.7/22.7/0.5 and 3304.6/775.0/16.2/0.1 respectively, again falling below the baseline measurement and closely in line with the results from the 10 ppm and 15 ppm tests found in Table 61 and Table 63. Again similar effects were seen with the co-solvents when testing was performed with the AvCount instrument, Table 66.

***0.5 mg/L A2 Fine Test Dust***

ISO 12103-1 A2 fine test dust was distributed in the EI 1581 test rig at 0.5 mg/L. Baseline particle counts on the ACM 20 were established at 2073.6/507.6/16.3/0.9 online (2153.8/512.7/11.7/0.1 bottle sample), a gravimetric sample was pulled and determined to be 0.55 mg/L. With the water injection set to 5 ppm, and confirmed via ASTM D3240 to be 5.0 ppm, online particle count readings of 8256.1/4039.5/307.9/2.8 were recorded. Two 1 liter samples; samples 8 and 7, Table 67; were pulled into tin plate steel F-style cans for particle counter analysis. Particle counts for these samples gave readings of 2586.3/899.4/63.6/1.8 and 2579.0/898.6/60.8/1.1 respectively. The Resolver additive was mixed into sample 8 while the 2-propanol co-solvent was added to sample 7 with the resulting particle counts dropping to 2045.5/485.4/14.9/0.6 and 2131.1/505.4/15.3/0.4 right in line with the original baseline measurement which had 1.2 ppm free water. Similar trends were seen with testing particle counts on the AvCount instrument, Table 68.

The water injection was increased to 10 ppm and confirmed via ASTM D3240 to be 8.8 ppm, with online particle count reading of 15547.6/8424.1/775.2/7.8. Two 1 liter samples; samples 11 and 12, Table 69; were pulled into tin plate steel F-style cans for particle counter analysis. Particle counts for these samples gave particle counts of 4083.9/2263.5/198.9/3.2 and 5212.6/2972.1/222.9/3.3 respectively again significantly lower than the online counts. When doped with the 2-propanol co-solvents and Resolver additive the particle counts dropped down to 1995.6/478.6/14.8/0.6 and 1848.1/398.7/9.1/0.3 respectively, falling slightly below the baseline measurement and as did the results obtained from the 5 ppm test found in Table 67. Again similar effects were seen with the co-solvents when testing was performed with the AvCount instrument, Table 70.

The water injection was increased to 15 ppm and confirmed via ASTM D3240 to be 15.2 ppm. Two 1 liter samples; samples 9 and 10, Table 71; were pulled into tin plate steel F-style cans for particle counter analysis. Particle counts for these samples gave particle counts of 4451.5/2612.2/250.9/3.4 and 8604.0/5485.1/365.7/6.1 respectively. When additized with the 2-propanol and Resolver additive the particle counts dropped down to 2027.9/467.1/13.3/0.4 and 1820.2/404.1/12.1/0.7 respectively, again falling below the baseline measurement and closely in line with the results from the 5 ppm and 10 ppm tests found in Table 67 and Table 69. Similar effects were seen with the co-solvents when testing was performed with the AvCount instrument,

Table 72 closely in line with the results from the 5 ppm and 10 ppm tests found in Table 68 and Table 70.

### *0.25 mg/L A2 Fine Test Dust*

ISO 12103-1 A2 fine test dust was distributed in the EI 1581 test rig at 0.25 mg/L. Baseline particle counts on the ACM 20 were established at 1285.6/308.4/12.0/0.8 online (1269.5/285.1/7.9/0.1 bottle sample), a gravimetric sample was pulled and determined to be 0.225 mg/L. With the water injection set to 10 ppm, and confirmed via ASTM D3240 to be 9.0 ppm, online particle count readings of 14418.7/7852.4/751.4/8.8 were recorded. Two 1 liter samples; samples 16 and 17, Table 73; were pulled into tin plate steel F-style cans for particle counter testing. Particle counts for these samples gave readings of 3397.9/1996.0/142.0/1.1 and 2447.1/1319.3/107.5/1.1 respectively. The 2-propanol co-solvent was mixed into sample 16 while the Resolver additive was added to sample 17 with the resulting particle counts dropping to 1287.9/294.6/8.6/0.1 and 1177.1/247.1/7.6/0.5 closely in line with the original baseline measurement which had 1.0 ppm free water. Similar trends were seen on the AvCount instrument, Table 74.

The water injection was increased to 15 ppm and confirmed via ASTM D3240 to be 17.0 ppm, with online particle counter reading of 19461.9/11166.2/1206.4/14.1. Two 1 liter samples; samples 15 and 18, Table 75; were pulled into tin plate steel F-style cans for particle counter analysis. Particle counts for these samples gave particle counts of 5700.9/3813.7/291.3/3.2 and 7311.1/4766.1/385.9/6.1 respectively again significantly lower than the online counts. When doped with the 2-propanol co-solvents and Resolver additive the particle counts dropped down to 1357.8/321.7/10.9/0.4 and 1078.6/224.6/6.4/0.5 respectively, near the baseline measurement and as did the results obtained from the 10 ppm test found in Table 73. Again similar effects were seen with the co-solvents when testing was performed with the AvCount instrument, Table 76.

The water injection was increased to 30 ppm and confirmed via ASTM D3240 to be 28.0 ppm, with online particle count readings increased to 30543.4/19192.9/3051.4/33.8. Two 1 liter samples; samples 17 and 19, Table 77; were pulled into tin plate steel F-style cans for particle counter analysis. Particle count testing for these samples gave particle counts of 16422.8/11720.1/834.8/12.6 and 12907.6/9121.4/409.7/2.1 respectively. When additized with the 2-propanol and Resolver additive the particle counts dropped down to 1248.1/288.1/6.9/0.2 and 1057.1/231.0/14.5/3.0 respectively, again falling below the baseline measurement and closely in line with the results from the 10 ppm and 15 ppm tests found in Table 73 and Table 75. Similar effects were seen with the additives when testing was performed with the AvCount instrument, Table 78 closely in line with the results from the 10 ppm and 15 ppm tests found in Table 74 and Table 76.

### *2.5 mg/L A1 Ultrafine Test Dust*

ISO 12103-1 A1 ultrafine test dust was dispersed in the EI 1581 test rig at 2.5 mg/L. Baseline particle counts on the ACM 20 were established at 15789.2/4867.6/19.4/0.5 online (16698.1/4660.4/12.7/0.1 bottle sample), a gravimetric sample was pulled and tested to be 2.1

mg/L. With the water injection set to 10 ppm, and confirmed via ASTM D3240 to be 10.2 ppm, online particle count readings of 23855.1/11085.7/705.7/8.0 were recorded. Two 1 liter samples; samples 6 and 14, Table 79; were pulled into tin plate steel F-style cans for particle counter analysis. Particle counts for these samples gave readings of 18260.8/6320.2/187.4/1.6 and 18789.3/6885.4/221.5/1.8 respectively. The Resolver additive was mixed into sample 6 while the 2-propanol co-solvent was added to sample 14 the resulting particle counts dropped to 16047.1/4494.3/13.8/0.6 and 15677.0/4448.4/15.8/0.1 aligning closely with the original baseline measurement which had 1.1 ppm free water. Similar trends were seen with testing particle counts on the AvCount instrument, Table 80.

The water injection was increased to 15 ppm and confirmed via ASTM D3240 to be 12.6 ppm, with online particle count reading of 23835.1/11085.7/705.7/8.0. Two 1 liter samples; samples 3 and 8, Table 81; were pulled into tin plate steel F-style cans for particle counter analysis. Particle counts for these samples gave particle counts of 16698.1/4660.4/12.7/0.1 and 18960.4/7214.0/203.1/0.8 respectively. When doped with the 2-propanol co-solvent and Resolver additive the particle counts dropped down to 15893.0/4470.8/16.6/0.4 and 15200.1/4117.4/10.6/0.1 respectively, again falling below the baseline measurement and as did the results obtained from the 10 ppm test found in Table 79. Again similar effects were seen with the with the AvCount instrument, Table 82.

The water injection was increased to 30 ppm and confirmed via ASTM D3240 to be 32.5 ppm, online particle count readings increased to 33383.6/19750.2/2858.5/33.8. Two 1 liter samples; samples 7 and 12, Table 83; were pulled into tin plate steel F-style cans for particle counter analysis. Particle counts for these samples gave particle counts of 26036.8/14240.7/850.6/8.6 and 25434.9/13736.0/660.6/1.9 respectively. When additized with the 2-propanol and Resolver additive the particle counts dropped down to 16493.1/4872.2/22.1/1.0 and 13612.1/3364.7/13.0/1.3 respectively, again falling below the baseline measurement and close to the results from the 10 ppm and 15 ppm tests found in Table 79 and Table 81. Similar effects were seen with the co-solvents when testing was performed with the AvCount instrument Table 84, closely in line with the results from the 10 ppm and 15 ppm tests found in Table 80 and Table 82.

### *2.0 mg/L A1 Ultrafine Test Dust*

ISO 12103-1 A1 ultrafine test dust was disseminated in the EI 1581 test rig at 2.0 mg/L. Baseline particle counts on the ACM 20 were established at 11830.1/3650.2/14.2/0.3 online (12541.5/3309.6/14.6/0.4 bottle sample), a gravimetric sample was pulled and determined to be 1.225 mg/L. The water injection was set to 10 ppm, and determined via ASTM D3240 to be 11.0 ppm, online particle count readings of 20933.7/10076.9/677.7/6.7 were recorded. Two 1 liter samples; samples 26 and 27, Table 85; gave readings of 16353.0/6855.7/309.7/2.4 and 13934.9/4945.1/197.1/2.4 respectively from metal sample cans. The 2-propanol co-solvent was mixed into sample 26 while the Resolver additive was added to sample 27 with the resulting particle counts dropping to 12096.6/3410.4/11.1/0.4 and 11636.6/3128.1/11.4/0.4 aligning closely with the original baseline measurement which was determined to have 1.5 ppm free

water. Similar trends were seen with testing particle counts on the AvCount instrument, Table 86.

The water injection was increased to 15 ppm and confirmed via ASTM D3240 to be 15.0 ppm, with online particle count reading of 24868.5/13072.0/1150.9/10.3. Two 1 liter samples; samples 25 and 28, Table 87; were pulled into tin plate steel F-style cans for particle counter analysis. Particle counts for these samples gave particle counts of 14713.5/6009.6/288.2/3.0 and 14662.6/6062.9/272.2/3.1 respectively. These particle counts are lower than the particle counts for the samples containing 10 ppm free water, presumably due to the time from sampling to testing being 18 minutes for sample 26 and 37 minutes for sample 25 and 28. When doped with the 2-propanol co-solvents and Resolver additive the particle counts dropped down to 11800.2/3328.3/11.1/0.2 and 10668.3/2825.4/11.9/0.9 respectively, below the baseline measurement and was seen in the results obtained from the 10 ppm test found in Table 85. Again similar effects were seen with the co-solvents when testing was performed with the AvCount instrument, Table 88.

The water injection was increased to 30 ppm and confirmed via ASTM D3240 to be 29.5 ppm, with online particle count readings increased to 32451.7/19610.9/2896.6/35.1. Two 1 liter samples; samples 30 and 29, Table 89; and tested to give particle counts of 19289.3/10688.1/735.2/10.6 and 25180.4/15654.7/1249.8/14.4 respectively. When additized with the 2-propanol and Resolver additive the particle counts dropped down to 11213.9/3127.2/13.6/0.9 and 10677.2/2923.5/23.0/2.4 respectively, again falling below the baseline measurement and close to the results from the 10 ppm and 15 ppm tests found in Table 85 and Table 87. Similar effects were seen with the co-solvents when testing was performed with the AvCount instrument, Table 90 closely in line with the results from the 10 ppm and 15 ppm tests found in Table 86 and Table 88.

## Data

## Glass Bottles

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | ACM 20 counts | | | | ACM 20 ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 2.0 | 1.1 | None | 4076.0 | 1420.4 | 66.3 | 1.3 | 19 | 18 | 13 | 7 |
| | in-line | 2.0 | 14.4 | None | 20121.0 | 11292.5 | 1122.6 | 13.6 | 22 | 21 | 17 | 11 |
| 1 | Glass | 2.0 | 1.1 | None | 4906.1 | 1741.4 | 55.1 | 2.3 | 19 | 18 | 13 | 8 |
| 1 | Glass | 2.0 | 1.1 | None | 4857.5 | 1677.6 | 49.6 | 1.4 | 19 | 18 | 13 | 8 |
| 1 | Glass | 2.0 | 1.1 | None | 4815.7 | 1673.1 | 39.1 | 1.0 | 19 | 18 | 12 | 7 |
| 2 | Glass | 2.0 | 1.1 | None | 4668.8 | 1559.1 | 42.4 | 1.1 | 19 | 18 | 13 | 7 |
| 2 | Glass | 2.0 | 1.1 | None | 4609.2 | 1524.4 | 30.9 | 0.4 | 19 | 18 | 12 | >6 |
| 2 | Glass | 2.0 | 1.1 | None | 4566.1 | 1484.1 | 21.2 | 0.3 | 19 | 18 | 12 | >5 |
| 1 | Glass | 2.0 | 1.1 | IPA | 5115.3 | 1896.6 | 72.9 | 1.7 | 20 | 18 | 13 | 8 |
| 1 | Glass | 2.0 | 1.1 | IPA | 4916.2 | 1728.4 | 30.0 | 0.8 | 19 | 18 | 12 | 7 |
| 1 | Glass | 2.0 | 1.1 | IPA | 4172.1 | 1235.8 | 8.2 | 0.2 | 19 | 17 | 10 | >5 |
| 2 | Glass | 2.0 | 1.1 | Resolver | 4883.1 | 1783.0 | 62.9 | 0.9 | 19 | 18 | 13 | 7 |
| 2 | Glass | 2.0 | 1.1 | Resolver | 4427.6 | 1474.2 | 21.5 | 0.4 | 19 | 18 | 12 | >6 |
| 2 | Glass | 2.0 | 1.1 | Resolver | 4175.2 | 1296.9 | 12.4 | 0.1 | 19 | 17 | 11 | >4 |
| 3 | Glass | 2.0 | 4.3 | None | 4190.1 | 1290.3 | 31.9 | 1.0 | 19 | 17 | 12 | 7 |
| 3 | Glass | 2.0 | 4.3 | None | 4147.1 | 1239.4 | 25.5 | 0.6 | 19 | 17 | 12 | >6 |
| 3 | Glass | 2.0 | 4.3 | None | 4063.7 | 1113.6 | 16.4 | 0.0 | 19 | 17 | 11 | >0 |
| 4 | Glass | 2.0 | 4.3 | None | 3960.8 | 1169.6 | 33.9 | 2.6 | 19 | 17 | 12 | 9 |
| 4 | Glass | 2.0 | 4.3 | None | 3882.7 | 1121.9 | 23.4 | 0.6 | 19 | 17 | 12 | >6 |
| 4 | Glass | 2.0 | 4.3 | None | 3845.8 | 1082.6 | 14.4 | 0.9 | 19 | 17 | 11 | 7 |
| 4 | Glass | 2.0 | 4.3 | None | 3827.2 | 1076.2 | 9.8 | 0.1 | 19 | 17 | 10 | >3 |
| 4 | Glass | 2.0 | 4.3 | None | 3627.3 | 979.4 | 5.5 | 0.3 | 19 | 17 | 10 | >5 |
| 4 | Glass | 2.0 | 4.3 | None | 3944.6 | 1161.9 | 12.1 | 0.2 | 19 | 17 | 11 | >5 |
| 7 | Glass | 2.0 | 14.4 | None | 4457.4 | 1772.1 | 85.4 | 1.1 | 19 | 18 | 14 | 7 |
| 7 | Glass | 2.0 | 14.4 | None | 4144.6 | 1517.9 | 61.6 | 1.2 | 19 | 18 | 13 | 7 |
| 8 | Glass | 2.0 | 14.4 | None | 6381.9 | 2395.9 | 86.5 | 2.3 | 20 | 18 | 14 | 8 |
| 8 | Glass | 2.0 | 14.4 | None | 5479.2 | 1898.9 | 59.7 | 1.4 | 20 | 18 | 13 | 8 |
| 8 | Glass | 2.0 | 14.4 | None | 5197.9 | 1691.2 | 38.6 | 0.6 | 20 | 18 | 12 | >6 |

**Table 2. 2.0 mg/L ISO 12103-1 A3 medium test dust and free water evaluation in glass bottles.**

**HDPE Bottles**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | ACM 20 counts | | | | ACM 20 ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | Inline | 1.0 | 10.0 | None | 15309.1 | 8047.4 | 658.5 | 7.4 | 21 | 20 | 17 | 10 |
| | Plastic | 1.0 | 1.3 | None | 2734.9 | 877.6 | 21.4 | 0.5 | 19 | 17 | 12 | >6 |
| | Plastic | 1.0 | 1.3 | None | 2672.6 | 859.5 | 16.1 | 0.3 | 19 | 17 | 11 | >5 |
| 2 | Plastic | 1.0 | 10.0 | None | 9192.2 | 5793.4 | 410.7 | 3.5 | 20 | 20 | 16 | 9 |
| 2 | Plastic | 1.0 | 10.0 | None | 8109.9 | 5102.6 | 393.7 | 5.7 | 20 | 20 | 16 | 10 |
| 1 | Plastic | 1.0 | 10.0 | None | 850.7 | 453.1 | 53.5 | 2.1 | 17 | 16 | 13 | 8 |
| 1 | Plastic | 1.0 | 10.0 | None | 716.7 | 381.1 | 54.1 | 5.2 | 17 | 16 | 13 | 10 |
| 2 | Plastic | 1.0 | 10.0 | Resolver | 2327.4 | 861.2 | 36.4 | 0.7 | 18 | 17 | 12 | 7 |
| 1 | Plastic | 1.0 | 10.0 | IPA | 1059.4 | 497.6 | 53.1 | 3.9 | 17 | 16 | 13 | 9 |

**Table 3. 1.0 mg/L ISO 12103-1 A3 medium test dust and 15 ppm free water 2-propanol and Resolver Parker ACM 20 evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | ACM 20 counts | | | | ACM 20 ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | Inline | 1.0 | 8.8 | None | 14283.8 | 7673.6 | 706.4 | 8.1 | 21 | 20 | 17 | 10 |
| | Plastic | 1.0 | 1.3 | None | 2734.9 | 877.6 | 21.4 | 0.5 | 19 | 17 | 12 | >6 |
| | Plastic | 1.0 | 1.3 | None | 2672.6 | 859.5 | 16.1 | 0.3 | 19 | 17 | 11 | >5 |
| 3 | Plastic | 1.0 | 8.8 | None | 1594.1 | 836.0 | 81.6 | 2.6 | 18 | 17 | 14 | 9 |
| 4 | Plastic | 1.0 | 8.8 | None | 2220.0 | 1066.9 | 68.0 | 2.4 | 18 | 17 | 13 | 8 |
| 3 | Plastic | 1.0 | 8.8 | IPA | 1354.1 | 483.5 | 26.6 | 1.4 | 18 | 16 | 12 | 8 |
| 4 | Plastic | 1.0 | 8.8 | Resolver | 2060.7 | 837.4 | 60.4 | 1.9 | 18 | 17 | 13 | 8 |

**Table 4. 1.0 mg/L ISO 12103-1 A3 medium test dust and 10 ppm free water 2-propanol and Resolver Parker ACM 20 evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | ACM 20 counts | | | | ACM 20 ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | Inline | 1.0 | 5.0 | Inline | 9173.4 | 4578.3 | 357.6 | 4.9 | 20 | 19 | 16 | 9 |
| | Plastic | 1.0 | 1.3 | None | 2734.9 | 877.6 | 21.4 | 0.5 | 19 | 17 | 12 | >6 |
| | Plastic | 1.0 | 1.3 | None | 2672.6 | 859.5 | 16.1 | 0.3 | 19 | 17 | 11 | >5 |
| 5 | Plastic | 1.0 | 5.0 | None | 4213.3 | 2164.5 | 162.6 | 3.1 | 19 | 18 | 15 | 9 |
| 5 | Plastic | 1.0 | 5.0 | None | 4108.7 | 2079.2 | 137.4 | 2.0 | 19 | 18 | 14 | 8 |
| 6 | Plastic | 1.0 | 5.0 | None | 1254.9 | 539.9 | 29.9 | 1.8 | 17 | 16 | 12 | 8 |
| 5 | Plastic | 1.0 | 5.0 | IPA | 2480.0 | 871.3 | 38.1 | 1.6 | 18 | 17 | 12 | 8 |
| 6 | Plastic | 1.0 | 5.0 | Resolver | 1439.4 | 582.8 | 41.6 | 3.4 | 18 | 16 | 13 | 9 |

**Table 5. 1.0 mg/L ISO 12103-1 A3 medium test dust and 5 ppm free water 2-propanol and Resolver Stanhope Seta AvCount evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | ACM 20 counts | | | | ACM 20 ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | Inline | 1.0 | 14.4 | Inline | 20077.4 | 11326.9 | 1229.1 | 17.3 | 22 | 21 | 17 | 11 |
| | Plastic | 1.0 | 1.3 | None | 2734.9 | 877.6 | 21.4 | 0.5 | 19 | 17 | 12 | >6 |
| | Plastic | 1.0 | 1.3 | None | 2672.6 | 859.5 | 16.1 | 0.3 | 19 | 17 | 11 | >5 |
| 7 | Plastic | 1.0 | 14.4 | None | 8799.0 | 5342.5 | 379.2 | 16.1 | 20 | 20 | 16 | 11 |
| 8 | Plastic | 1.0 | 14.4 | None | 5585.6 | 3082.7 | 127.6 | 4.6 | 20 | 19 | 14 | 9 |
| 7 | Plastic | 1.0 | 14.4 | IPA | 1900.1 | 680.1 | 35.3 | 1.2 | 18 | 17 | 12 | 7 |
| 8 | Plastic | 1.0 | 14.4 | Resolver | 2269.2 | 887.9 | 62.4 | 5.1 | 18 | 17 | 13 | 10 |

**Table 6. 1.0 mg/L ISO 12103-1 A3 medium test dust and 20 ppm free water 2-propanol and Resolver Parker ACM 20 evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | ACM 20 counts | | | | ACM 20 ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 1.0 | 1.5 | None | 5962.4 | 1822.4 | 17.5 | 1.2 | 20 | 18 | 11 | 7 |
| | in-line | 1.0 | 4.5 | None | 12824.1 | 5773.9 | 281.0 | 3.5 | 21 | 20 | 15 | 9 |
| | Plastic | 1.0 | 1.5 | None | 7303.9 | 2108.6 | 15.3 | 0.7 | 20 | 18 | 11 | 7 |
| 5 | Plastic | 1.0 | 4.5 | None | 2432.6 | 858.9 | 56.3 | 10.1 | 18 | 17 | 13 | 11 |
| 6 | Plastic | 1.0 | 4.5 | None | 6517.0 | 2148.1 | 61.1 | 1.7 | 20 | 18 | 13 | 8 |
| 5 | Plastic | 1.0 | 4.5 | IPA | 3437.9 | 1142.9 | 48.1 | 6.3 | 19 | 17 | 13 | 10 |
| 6 | Plastic | 1.0 | 4.5 | Resolver | 6531.8 | 2079.9 | 45.7 | 1.6 | 20 | 18 | 13 | 8 |

**Table 7. 1.0 mg/L ISO 12103-1 A1 ultrafine test dust and 5 ppm free water 2-propanol and Resolver Parker ACM 20 evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | SETA counts | | | | SETA ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 1.0 | 1.5 | None | 8041.3 | 3724.8 | 60.9 | 0.6 | 20 | 19 | 13 | 6 |
| | in-line | 1.0 | 4.5 | None | 15794.7 | 9304.7 | 1281.8 | 31.8 | 21 | 20 | 17 | 12 |
| | Plastic | 1.0 | 1.5 | None | | | | | | | | |
| 5 | Plastic | 1.0 | 4.5 | None | 3156.8 | 1425.8 | 66.5 | 4.3 | 19 | 18 | 13 | 9 |
| 6 | Plastic | 1.0 | 4.5 | None | 7656.8 | 3608.0 | 200.3 | 8.7 | 20 | 19 | 15 | 10 |
| 5 | Plastic | 1.0 | 4.5 | IPA | 8980.2 | 3407.3 | 159.6 | 5.9 | 20 | 19 | 14 | 10 |
| 6 | Plastic | 1.0 | 4.5 | Resolver | 8823.9 | 4046.6 | 165.9 | 6.8 | 20 | 19 | 15 | 10 |

**Table 8. 1.0 mg/L ISO 12103-1 A1 ultrafine test dust and 5 ppm free water 2-propanol and Resolver Stanhope Seta AvCount evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | ACM 20 counts | | | | ACM 20 ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 1.0 | 1.5 | None | 5962.4 | 1822.4 | 17.5 | 1.2 | 20 | 18 | 11 | 7 |
| | in-line | 1.0 | 10.0 | None | 18913.1 | 9654.4 | 678.1 | 6.4 | 21 | 20 | 17 | 10 |
| | Plastic | 1.0 | 1.5 | None | 7303.9 | 2108.6 | 15.3 | 0.7 | 20 | 18 | 11 | 7 |
| 3 | Plastic | 1.0 | 10.0 | None | 4418.1 | 1945.5 | 151.5 | 2.4 | 19 | 18 | 14 | 8 |
| 4 | Plastic | 1.0 | 10.0 | None | 2013.7 | 695.3 | 39.2 | 2.6 | 18 | 17 | 12 | 9 |
| 3 | Plastic | 1.0 | 10.0 | IPA | 4804.8 | 1720.0 | 60.5 | 2.1 | 19 | 18 | 13 | 8 |
| 4 | Plastic | 1.0 | 10.0 | Resolver | 3781.5 | 1325.0 | 52.1 | 2.4 | 19 | 18 | 13 | 8 |

**Table 9. 1.0 mg/L ISO 12103-1 A1 ultrafine test dust and 10 ppm free water 2-propanol and Resolver Parker ACM 20 evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | SETA counts | | | | SETA ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 1.0 | 1.5 | None | 8041.3 | 3724.8 | 60.9 | 0.6 | 20 | 19 | 13 | 6 |
| | in-line | 1.0 | 10.0 | None | 21810.5 | 14214.2 | 2448.6 | 62.7 | 22 | 21 | 18 | 13 |
| | Plastic | 1.0 | 1.5 | None | | | | | | | | |
| 3 | Plastic | 1.0 | 10.0 | None | | | | | | | | |
| 4 | Plastic | 1.0 | 10.0 | None | | | | | | | | |
| 3 | Plastic | 1.0 | 10.0 | IPA | | | | | | | | |
| 4 | Plastic | 1.0 | 10.0 | Resolver | | | | | | | | |

**Table 10. 1.0 mg/L ISO 12103-1 A1 ultrafine test dust and 10 ppm free water 2-propanol and Resolver Stanhope Seta AvCount evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | ACM 20 counts | | | | ACM 20 ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 1.0 | 1.5 | None | 5962.4 | 1822.4 | 17.5 | 1.2 | 20 | 18 | 11 | 7 |
| | in-line | 1.0 | 12.4 | None | 21621.5 | 11475.1 | 904.3 | 9.9 | 22 | 21 | 17 | 10 |
| | Plastic | 1.0 | 1.5 | None | 7303.9 | 2108.6 | 15.3 | 0.7 | 20 | 18 | 11 | 7 |
| 2 | Plastic | 1.0 | 12.4 | None | 15965.5 | 8979.0 | 511.3 | 4.2 | 21 | 20 | 16 | 9 |
| 1 | Plastic | 1.0 | 12.4 | None | 6168.8 | 3669.3 | 335.1 | 4.7 | 20 | 19 | 16 | 9 |
| 2 | Plastic | 1.0 | 12.4 | Resolver | 6499.6 | 2006.5 | 26.2 | 2.3 | 20 | 18 | 12 | 8 |
| 1 | Plastic | 1.0 | 12.4 | IPA | 3718.1 | 1412.7 | 79.6 | 8.1 | 19 | 18 | 13 | 10 |

**Table 11. 1.0 mg/L ISO 12103-1 A1 ultrafine test dust and 15 ppm free water 2-propanol and Resolver Parker ACM 20 evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | SETA counts | | | | SETA ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 1.0 | 1.5 | None | 8041.3 | 3724.8 | 60.9 | 0.6 | 20 | 19 | 13 | 6 |
| | in-line | 1.0 | 12.4 | None | 26370.1 | 17781.6 | 3342.3 | 90.6 | 22 | 21 | 19 | 14 |
| | Plastic | 1.0 | 1.5 | None | | | | | | | | |
| 2 | Plastic | 1.0 | 12.4 | None | | | | | | | | |
| 1 | Plastic | 1.0 | 12.4 | None | | | | | | | | |
| 2 | Plastic | 1.0 | 12.4 | Resolver | | | | | | | | |
| 1 | Plastic | 1.0 | 12.4 | IPA | | | | | | | | |

**Table 12. 1.0 mg/L ISO 12103-1 A1 ultrafine test dust and 15 ppm free water 2-propanol and Resolver Stanhope Seta AvCount evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | ACM 20 counts | | | | ACM 20 ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 0.5 | 1.3 | None | 3554.2 | 1028.7 | 9.2 | 0.6 | 19 | 17 | 10 | >6 |
| | in-line | 0.5 | 5.5 | None | 10962.9 | 5238.9 | 300.1 | 4.0 | 21 | 20 | 15 | 9 |
| | Plastic | 0.5 | 1.3 | None | 3743.9 | 980.7 | 7.8 | 0.6 | 19 | 17 | 10 | >6 |
| 11 | Plastic | 0.5 | 5.5 | None | 1567.1 | 468.9 | 14.5 | 1.5 | 18 | 16 | 11 | 8 |
| 12 | Plastic | 0.5 | 5.5 | None | 1221.1 | 389.7 | 15.6 | 1.1 | 17 | 16 | 11 | 7 |
| 11 | Plastic | 0.5 | 5.5 | IPA | 2483.3 | 744.6 | 15.7 | 0.4 | 18 | 17 | 11 | >6 |
| 12 | Plastic | 0.5 | 5.5 | Resolver | 2049.4 | 787.7 | 43.7 | 5.7 | 18 | 17 | 13 | 10 |

**Table 13. 0.5 mg/L ISO 12103-1 A1 ultrafine test dust and 5 ppm free water 2-propanol and Resolver Parker ACM 20 evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | SETA counts | | | | SETA ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 0.5 | 1.3 | None | | | | | | | | |
| | in-line | 0.5 | 5.5 | None | | | | | | | | |
| | Plastic | 0.5 | 1.3 | None | 5118.3 | 2192.8 | 27.6 | 1.7 | 20 | 18 | 12 | 8 |
| 11 | Plastic | 0.5 | 5.5 | None | 2219.6 | 952.1 | 43.5 | 2.5 | 18 | 17 | 13 | 8 |
| 12 | Plastic | 0.5 | 5.5 | None | 1506.5 | 635.7 | 40.0 | 3.2 | 18 | 16 | 12 | 9 |
| 11 | Plastic | 0.5 | 5.5 | IPA | 5419.6 | 1918.5 | 50.4 | 1.0 | 20 | 18 | 13 | 7 |
| 12 | Plastic | 0.5 | 5.5 | Resolver | 3000.3 | 1448.5 | 96.5 | 3.9 | 19 | 18 | 14 | 9 |

**Table 14. 0.5 mg/L ISO 12103-1 A1 ultrafine test dust and 5 ppm free water 2-propanol and Resolver Stanhope Seta AvCount evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | ACM 20 counts | | | | ACM 20 ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 0.5 | 1.3 | None | 3554.2 | 1028.7 | 9.2 | 0.6 | 19 | 17 | 10 | >6 |
| | in-line | 0.5 | 10.8 | None | 17791.6 | 9449.7 | 711.5 | 5.7 | 21 | 20 | 17 | 10 |
| | Plastic | 0.5 | 1.3 | None | 3743.9 | 980.7 | 7.8 | 0.6 | 19 | 17 | 10 | >6 |
| 10 | Plastic | 0.5 | 10.8 | None | 3645.1 | 1578.6 | 83.6 | 3.5 | 19 | 18 | 14 | 9 |
| 10 | Plastic | 0.5 | 10.8 | Resolver | 2927.2 | 973.6 | 29.3 | 1.9 | 19 | 17 | 12 | 8 |

**Table 15. 0.5 mg/L ISO 12103-1 A1 ultrafine test dust and 10 ppm free water 2-propanol and Resolver Parker ACM 20 evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | SETA counts | | | | SETA ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 0.5 | 1.3 | None | | | | | | | | |
| | in-line | 0.5 | 10.8 | None | | | | | | | | |
| | Plastic | 0.5 | 1.3 | None | 5118.3 | 2192.8 | 27.6 | 1.7 | 20 | 18 | 12 | 8 |
| 10 | Plastic | 0.5 | 10.8 | None | 3860.8 | 1973.4 | 269.3 | 14.8 | 19 | 18 | 15 | 11 |
| 10 | Plastic | 0.5 | 10.8 | Resolver | 4400.3 | 2048.6 | 118.0 | 7.1 | 19 | 18 | 14 | 10 |

**Table 16. 0.5 mg/L ISO 12103-1 A1 ultrafine test dust and 10 ppm free water 2-propanol and Resolver Stanhope Seta AvCount evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | ACM 20 counts | | | | ACM 20 ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 0.5 | 1.3 | None | 3554.2 | 1028.7 | 9.2 | 0.6 | 19 | 17 | 10 | >6 |
| | in-line | 0.5 | 17.6 | None | 20584.0 | 11276.1 | 935.3 | 9.1 | 22 | 21 | 17 | 10 |
| | Plastic | 0.5 | 1.3 | None | 3743.9 | 980.7 | 7.8 | 0.6 | 19 | 17 | 10 | >6 |
| 8 | Plastic | 0.5 | 17.6 | None | 7966.4 | 5068.6 | 333.9 | 3.6 | 20 | 20 | 16 | 9 |
| 7 | Plastic | 0.5 | 17.6 | None | 1972.7 | 916.9 | 75.1 | 3.8 | 18 | 17 | 13 | 9 |
| 8 | Plastic | 0.5 | 17.6 | Resolver | 3490.0 | 1164.1 | 29.9 | 1.7 | 19 | 17 | 12 | 8 |
| 7 | Plastic | 0.5 | 17.6 | IPA | 2553.4 | 786.6 | 14.9 | 1.0 | 19 | 17 | 11 | 7 |

**Table 17. 0.5 mg/L ISO 12103-1 A1 ultrafine test dust and 15 ppm free water 2-propanol and Resolver Parker ACM 20 evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | SETA counts | | | | SETA ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 0.5 | 1.3 | None | | | | | | | | |
| | in-line | 0.5 | 17.6 | None | | | | | | | | |
| | Plastic | 0.5 | 1.3 | None | 5118.3 | 2192.8 | 27.6 | 1.7 | 20 | 18 | 12 | 8 |
| 8 | Plastic | 0.5 | 17.6 | None | 7879.6 | 5452.2 | 1390.5 | 55.5 | 20 | 20 | 18 | 13 |
| 7 | Plastic | 0.5 | 17.6 | None | 2076.0 | 1078.9 | 206.3 | 14.8 | 18 | 17 | 15 | 11 |
| 8 | Plastic | 0.5 | 17.6 | Resolver | 4918.8 | 2335.5 | 123.8 | 8.3 | 19 | 18 | 14 | 10 |
| 7 | Plastic | 0.5 | 17.6 | IPA | 6063.4 | 2209.0 | 70.2 | 2.2 | 20 | 18 | 13 | 8 |

**Table 18. 0.5 mg/L ISO 12103-1 A1 ultrafine test dust and 15 ppm free water 2-propanol and Resolver Stanhope Seta AvCount evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | ACM 20 counts | | | | ACM 20 ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 0.25 | 1.7 | None | 2823.4 | 787.6 | 7.2 | 0.8 | 19 | 17 | 10 | 7 |
| | in-line | 0.25 | 5.2 | None | 10123.5 | 4914.6 | 292.9 | 3.4 | 21 | 19 | 15 | 9 |
| | Plastic | 0.25 | 1.7 | None | 633.0 | 190.4 | 1.9 | 0.1 | 16 | 15 | 8 | >3 |
| | Glass | 0.25 | 1.7 | None | 2850.4 | 661.2 | 4.4 | 0.7 | 19 | 17 | 9 | 7 |
| 6 | Plastic | 0.25 | 5.2 | None | 1592.6 | 462.5 | 16.5 | 1.1 | 18 | 16 | 11 | 7 |
| 1 | Plastic | 0.25 | 5.2 | None | 1317.6 | 359.9 | 10.9 | 0.4 | 18 | 16 | 11 | >6 |
| 6 | Plastic | 0.25 | 5.2 | Resolver | 2390.7 | 833.2 | 27.3 | 0.9 | 18 | 17 | 12 | 7 |
| 1 | Plastic | 0.25 | 5.2 | IPA | 2234.1 | 703.6 | 26.1 | 2.0 | 18 | 17 | 12 | 8 |

**Table 19. 0.25 mg/L ISO 12103-1 A1 ultrafine test dust and 5 ppm free water 2-propanol and Resolver Parker ACM 20 evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | SETA counts | | | | SETA ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 0.25 | 1.7 | None | | | | | | | | |
| | in-line | 0.25 | 5.2 | None | | | | | | | | |
| | Plastic | 0.25 | 1.7 | None | 1099.6 | 500.8 | 41.9 | 9.3 | 17 | 16 | 13 | 10 |
| | Glass | 0.25 | 1.7 | None | 3954.1 | 1589.8 | 38.5 | 5.5 | 19 | 18 | 12 | 10 |
| 6 | Plastic | 0.25 | 5.2 | None | 2490.1 | 964.9 | 41.5 | 2.3 | 18 | 17 | 13 | 8 |
| 1 | Plastic | 0.25 | 5.2 | None | 1913.4 | 724.6 | 41.2 | 4.5 | 18 | 17 | 13 | 9 |
| 6 | Plastic | 0.25 | 5.2 | Resolver | 3346.3 | 1575.9 | 89.5 | 1.6 | 19 | 18 | 14 | 8 |
| 1 | Plastic | 0.25 | 5.2 | IPA | 4234.9 | 1819.0 | 79.7 | 3.3 | 19 | 18 | 13 | 9 |

**Table 20. 0.25 mg/L ISO 12103-1 A1 ultrafine test dust and 5 ppm free water 2-propanol and Resolver Stanhope Seta AvCount evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | ACM 20 counts | | | | ACM 20 ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 0.25 | 1.7 | None | 2823.4 | 787.6 | 7.2 | 0.8 | 19 | 17 | 10 | 7 |
| | in-line | 0.25 | 11.2 | None | 17673.8 | 7570.1 | 757.4 | 8.1 | 21 | 20 | 17 | 10 |
| | Plastic | 0.25 | 1.7 | None | 633.0 | 190.4 | 1.9 | 0.1 | 16 | 15 | 8 | >3 |
| | Glass | 0.25 | 1.7 | None | 2850.4 | 661.2 | 4.4 | 0.7 | 19 | 17 | 9 | 7 |
| 2 | Plastic | 0.25 | 11.2 | None | 1695.6 | 758.6 | 43.6 | 3.7 | 18 | 17 | 13 | 9 |
| 3 | Plastic | 0.25 | 11.2 | None | 1383.2 | 597.4 | 39.2 | 3.5 | 18 | 16 | 12 | 9 |
| 2 | Plastic | 0.25 | 11.2 | Resolver | 1628.9 | 547.0 | 25.4 | 3.0 | 18 | 16 | 12 | 9 |
| 3 | Plastic | 0.25 | 11.2 | IPA | 1956.9 | 748.8 | 20.0 | 1.4 | 18 | 17 | 11 | 8 |

**Table 21. 0.25 mg/L ISO 12103-1 A1 ultrafine test dust and 10 ppm free water 2-propanol and Resolver Parker ACM 20 evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | SETA counts | | | | SETA ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 0.25 | 1.7 | None | | | | | | | | |
| | in-line | 0.25 | 11.2 | None | | | | | | | | |
| | Plastic | 0.25 | 1.7 | None | 1099.6 | 500.8 | 41.9 | 9.3 | 17 | 16 | 13 | 10 |
| | Glass | 0.25 | 1.7 | None | 3954.1 | 1589.8 | 38.5 | 5.5 | 19 | 18 | 12 | 10 |
| 2 | Plastic | 0.25 | 11.2 | None | 2298.7 | 1046.5 | 157.3 | 6.9 | 18 | 17 | 14 | 10 |
| 3 | Plastic | 0.25 | 11.2 | None | 1803.1 | 892.7 | 147.6 | 8.4 | 18 | 17 | 14 | 10 |
| 2 | Plastic | 0.25 | 11.2 | Resolver | 2317.4 | 1060.4 | 60.2 | 3.2 | 18 | 17 | 13 | 9 |
| 3 | Plastic | 0.25 | 11.2 | IPA | 3706.3 | 1603.2 | 77.1 | 2.0 | 19 | 18 | 13 | 8 |

**Table 22. 0.25 mg/L ISO 12103-1 A1 ultrafine test dust and 10 ppm free water 2-propanol and Resolver Stanhope Seta AvCount evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | ACM 20 counts | | | | ACM 20 ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 0.25 | 1.7 | None | 2823.4 | 787.6 | 7.2 | 0.8 | 19 | 17 | 10 | 7 |
| | in-line | 0.25 | 15.2 | None | 22296.9 | 12528.4 | 1158.9 | 9.7 | 22 | 21 | 17 | 10 |
| | Plastic | 0.25 | 1.7 | None | 633.0 | 190.4 | 1.9 | 0.1 | 16 | 15 | 8 | >3 |
| | Glass | 0.25 | 1.7 | None | 2850.4 | 661.2 | 4.4 | 0.7 | 19 | 17 | 9 | 7 |
| 4 | Plastic | 0.25 | 15.2 | None | 5875.8 | 3234.3 | 213.1 | 11.7 | 20 | 19 | 15 | 11 |
| 5 | Plastic | 0.25 | 15.2 | None | 3927.3 | 2213.6 | 215.2 | 18.4 | 19 | 18 | 15 | 11 |
| 4 | Plastic | 0.25 | 15.2 | Resolver | 2641.8 | 796.1 | 14.2 | 0.4 | 19 | 17 | 11 | >6 |
| 5 | Plastic | 0.25 | 15.2 | IPA | 2588.9 | 896.6 | 18.4 | 0.5 | 19 | 17 | 11 | >6 |

**Table 23. 0.25 mg/L ISO 12103-1 A1 ultrafine test dust and 15 ppm free water 2-propanol and Resolver Parker ACM 20 evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | SETA counts | | | | SETA ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 0.25 | 1.7 | None | | | | | | | | |
| | in-line | 0.25 | 15.2 | None | | | | | | | | |
| | Plastic | 0.25 | 1.7 | None | 1099.6 | 500.8 | 41.9 | 9.3 | 17 | 16 | 13 | 10 |
| | Glass | 0.25 | 1.7 | None | 3954.1 | 1589.8 | 38.5 | 5.5 | 19 | 18 | 12 | 10 |
| 4 | Plastic | 0.25 | 15.2 | None | 6003.1 | 3839.3 | 851.0 | 35.5 | 20 | 19 | 17 | 12 |
| 5 | Plastic | 0.25 | 15.2 | None | 4034.9 | 2551.4 | 622.2 | 39.9 | 19 | 19 | 16 | 12 |
| 4 | Plastic | 0.25 | 15.2 | Resolver | 3757.8 | 1704.8 | 61.0 | 1.3 | 19 | 18 | 13 | 7 |
| 5 | Plastic | 0.25 | 15.2 | IPA | 5254.3 | 2192.5 | 82.4 | 1.3 | 20 | 18 | 14 | 8 |

**Table 24. 0.25 mg/L ISO 12103-1 A1 ultrafine test dust and 15 ppm free water 2-propanol and Resolver Stanhope Seta AvCount evaluation.**

**Tin Cans**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | ACM 20 counts | | | | ACM 20 ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 2.5 | 0.7 | None | 4883.6 | 1692.1 | 86.6 | 2.4 | 19 | 18 | 14 | 8 |
| | in-line | 2.5 | 8.0 | None | 16616.9 | 8847.9 | 749.5 | 8.5 | 21 | 20 | 17 | 10 |
| | Metal | 2.5 | 0.7 | None | 5065.9 | 1745.5 | 65.1 | 1.8 | 20 | 18 | 13 | 8 |
| 17 | Metal | 2.5 | 8.0 | None | 9149.4 | 5050.0 | 245.0 | 3.4 | 20 | 20 | 15 | 9 |
| 21 | Metal | 2.5 | 8.0 | None | 8407.1 | 4483.3 | 256.9 | 4.2 | 20 | 19 | 15 | 9 |
| 17 | Metal | 2.5 | 8.0 | IPA | 4745.9 | 1655.5 | 64.3 | 5.5 | 19 | 18 | 13 | 10 |
| 21 | Metal | 2.5 | 8.0 | Resolver | 4575.1 | 1564.6 | 63.1 | 2.9 | 19 | 18 | 13 | 9 |

**Table 25. 2.5 mg/L ISO 12103-1 A3 medium test dust and 10 ppm free water 2-propanol and Resolver Parker ACM 20 evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | SETA counts | | | | SETA ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 2.5 | 0.7 | None | | | | | | | | |
| | in-line | 2.5 | 8.0 | None | | | | | | | | |
| | Metal | 2.5 | 0.7 | None | 7376.5 | 2158.1 | 250.6 | 9.6 | 20 | 19 | 15 | 10 |
| 17 | Metal | 2.5 | 8.0 | None | 10749.6 | 6530.5 | 1463.0 | 43.3 | 21 | 20 | 18 | 13 |
| 21 | Metal | 2.5 | 8.0 | None | 10078.2 | 5888.8 | 1302.8 | 55.6 | 21 | 20 | 18 | 13 |
| 17 | Metal | 2.5 | 8.0 | IPA | 7027.5 | 3023.0 | 241.9 | 8.0 | 20 | 19 | 15 | 10 |
| 21 | Metal | 2.5 | 8.0 | Resolver | 6807.5 | 2849.8 | 201.5 | 7.6 | 20 | 19 | 15 | 10 |

**Table 26. 2.5 mg/L ISO 12103-1 A3 medium test dust and 10 ppm free water 2-propanol and Resolver Stanhope Seta AvCount evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | ACM 20 counts | | | | ACM 20 ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 2.5 | 0.7 | None | 4883.6 | 1692.1 | 86.6 | 2.4 | 19 | 18 | 14 | 8 |
| | in-line | 2.5 | 16.2 | None | 20350.1 | 11330.4 | 1077.8 | 12.9 | 22 | 21 | 17 | 11 |
| | Metal | 2.5 | 0.7 | None | 5065.9 | 1745.5 | 65.1 | 1.8 | 20 | 18 | 13 | 8 |
| 9 | Metal | 2.5 | 16.2 | None | 10450.2 | 6109.1 | 314.3 | 3.4 | 21 | 20 | 15 | 9 |
| 19 | Metal | 2.5 | 16.2 | None | 9683.7 | 5452.6 | 203.1 | 3.4 | 20 | 20 | 15 | 9 |
| 9 | Metal | 2.5 | 16.2 | IPA | 4621.3 | 1598.8 | 62.3 | 3.6 | 19 | 18 | 13 | 9 |
| 19 | Metal | 2.5 | 16.2 | Resolver | 4248.6 | 1390.3 | 55.3 | 2.4 | 19 | 18 | 13 | 8 |

**Table 27. 2.5 mg/L ISO 12103-1 A3 medium test dust and 15 ppm free water 2-propanol and Resolver Parker ACM 20 evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | SETA counts | | | | SETA ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 2.5 | 0.7 | None | | | | | | | | |
| | in-line | 2.5 | 16.2 | None | | | | | | | | |
| | Metal | 2.5 | 0.7 | None | 7376.5 | 2158.1 | 250.6 | 9.6 | 20 | 19 | 15 | 10 |
| 9 | Metal | 2.5 | 16.2 | None | 11977.9 | 7838.0 | 1879.3 | 55.6 | 21 | 20 | 18 | 13 |
| 19 | Metal | 2.5 | 16.2 | None | 11056.1 | 6960.3 | 1487.7 | 27.4 | 21 | 20 | 18 | 12 |
| 9 | Metal | 2.5 | 16.2 | IPA | 6959.3 | 2952.8 | 247.0 | 9.5 | 20 | 19 | 15 | 10 |
| 19 | Metal | 2.5 | 16.2 | Resolver | 6425.6 | 2533.3 | 161.2 | 5.6 | 20 | 19 | 15 | 10 |

**Table 28. 2.5 mg/L ISO 12103-1 A3 medium test dust and 15 ppm free water 2-propanol and Resolver Stanhope Seta AvCount evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | ACM 20 counts | | | | ACM 20 ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 2.5 | 0.7 | None | 4883.6 | 1692.1 | 86.6 | 2.4 | 19 | 18 | 14 | 8 |
| | in-line | 2.5 | 18.5 | None | 30518.9 | 18773.3 | 2768.3 | 30.8 | 22 | 21 | 19 | 12 |
| | Metal | 2.5 | 0.7 | None | 5065.9 | 1745.5 | 65.1 | 1.8 | 20 | 18 | 13 | 8 |
| 5 | Metal | 2.5 | 18.5 | None | 18522.4 | 12324.7 | 681.7 | 2.5 | 21 | 21 | 17 | 8 |
| 10 | Metal | 2.5 | 18.5 | None | 19792.4 | 13216.5 | 724.0 | 2.3 | 21 | 21 | 17 | 8 |
| 5 | Metal | 2.5 | 18.5 | IPA | 4664.5 | 1616.4 | 64.4 | 5.1 | 19 | 18 | 13 | 10 |
| 10 | Metal | 2.5 | 18.5 | Resolver | 3788.7 | 1095.0 | 29.0 | 1.7 | 19 | 17 | 12 | 8 |

**Table 29. 2.5 mg/L ISO 12103-1 A3 medium test dust and 30 ppm free water 2-propanol and Resolver Parker ACM 20 evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | SETA counts | | | | SETA ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 2.5 | 0.7 | None | | | | | | | | |
| | in-line | 2.5 | 18.5 | None | | | | | | | | |
| | Metal | 2.5 | 0.7 | None | 7376.5 | 2158.1 | 250.6 | 9.6 | 20 | 19 | 15 | 10 |
| 5 | Metal | 2.5 | 18.5 | None | 20339.6 | 15690.7 | 4418.0 | 109.2 | 22 | 21 | 19 | 14 |
| 10 | Metal | 2.5 | 18.5 | None | 21490.7 | 16747.7 | 4643.7 | 117.3 | 22 | 21 | 19 | 14 |
| 5 | Metal | 2.5 | 18.5 | IPA | 7027.1 | 2962.9 | 265.7 | 7.7 | 20 | 19 | 15 | 10 |
| 10 | Metal | 2.5 | 18.5 | Resolver | 6117.8 | 2288.7 | 115.2 | 3.5 | 20 | 18 | 14 | 9 |

**Table 30. 2.5 mg/L ISO 12103-1 A3 medium test dust and 30 ppm free water 2-propanol and Resolver Stanhope Seta AvCount evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | ACM 20 counts | | | | ACM 20 ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 2.0 | 0.8 | None | 4076.0 | 1420.4 | 66.3 | 1.3 | 19 | 18 | 13 | 7 |
| | in-line | 2.0 | 8.6 | None | 15451.1 | 8243.9 | 694.3 | 8.5 | 21 | 20 | 17 | 10 |
| | Metal | 2.0 | 0.8 | None | 4280.1 | 1543.4 | 47.2 | 0.7 | 19 | 18 | 13 | 7 |
| 20 | Metal | 2.0 | 8.6 | None | 13938.9 | 8467.9 | 495.1 | 4.4 | 21 | 20 | 16 | 9 |
| 18 | Metal | 2.0 | 8.6 | None | 8258.5 | 4779.7 | 281.4 | 2.4 | 20 | 19 | 15 | 8 |
| 20 | Metal | 2.0 | 8.6 | Resolver | 3827.3 | 1324.6 | 48.8 | 3.1 | 19 | 18 | 13 | 9 |
| 18 | Metal | 2.0 | 8.6 | IPA | 3921.3 | 1406.1 | 46.3 | 2.0 | 19 | 18 | 13 | 8 |

**Table 31. 2.0 mg/L ISO 12103-1 A3 medium test dust and 10 ppm free water 2-propanol and Resolver Parker ACM 20 evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | SETA counts | | | | SETA ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 2.0 | 0.8 | None | | | | | | | | |
| | in-line | 2.0 | 8.6 | None | | | | | | | | |
| | Metal | 2.0 | 0.8 | None | 5817.9 | 2518.1 | 201.8 | 6.6 | 20 | 19 | 15 | 10 |
| 20 | Metal | 2.0 | 8.6 | None | 13222.6 | 9429.7 | 2549.1 | 105.5 | 21 | 20 | 19 | 14 |
| 18 | Metal | 2.0 | 8.6 | None | 8885.5 | 5583.9 | 1391.3 | 54.7 | 20 | 20 | 18 | 13 |
| 20 | Metal | 2.0 | 8.6 | Resolver | 5568.7 | 2396.6 | 181.0 | 5.5 | 20 | 18 | 15 | 10 |
| 18 | Metal | 2.0 | 8.6 | IPA | 5568.7 | 2456.6 | 194.5 | 4.7 | 20 | 18 | 15 | 9 |

**Table 32. 2.0 mg/L ISO 12103-1 A3 medium test dust and 10 ppm free water 2-propanol and Resolver Stanhope Seta AvCount evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | ACM 20 counts | | | | ACM 20 ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 2.0 | 0.8 | None | 4076.0 | 1420.4 | 66.3 | 1.3 | 19 | 18 | 13 | 7 |
| | in-line | 2.0 | 16.0 | None | 20121.0 | 11292.5 | 1122.6 | 13.6 | 22 | 21 | 17 | 11 |
| | Metal | 2.0 | 0.8 | None | 4280.1 | 1543.4 | 47.2 | 0.7 | 19 | 18 | 13 | 7 |
| 1 | Metal | 2.0 | 16.0 | None | 7683.5 | 4373.1 | 285.4 | 2.6 | 20 | 19 | 15 | 9 |
| 2 | Metal | 2.0 | 16.0 | None | 8206.3 | 4811.6 | 266.8 | 3.1 | 20 | 19 | 15 | 9 |
| 1 | Metal | 2.0 | 16.0 | IPA | 3758.4 | 1322.9 | 46.6 | 3.6 | 19 | 18 | 13 | 9 |
| 2 | Metal | 2.0 | 16.0 | Resolver | 3289.9 | 1053.1 | 29.0 | 0.6 | 19 | 17 | 12 | >6 |

**Table 33. 2.0 mg/L ISO 12103-1 A3 medium test dust and 15 ppm free water 2-propanol and Resolver Parker ACM 20 evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | SETA counts | | | | SETA ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 2.0 | 0.8 | None | | | | | | | | |
| | in-line | 2.0 | 16.0 | None | | | | | | | | |
| | Metal | 2.0 | 0.8 | None | 5817.9 | 2518.1 | 201.8 | 6.6 | 20 | 19 | 15 | 10 |
| 1 | Metal | 2.0 | 16.0 | None | 8912.2 | 5656.2 | 1455.9 | 67.5 | 20 | 20 | 18 | 13 |
| 2 | Metal | 2.0 | 16.0 | None | 9675.4 | 6417.7 | 1620.1 | 60.4 | 20 | 20 | 18 | 13 |
| 1 | Metal | 2.0 | 16.0 | IPA | 5464.3 | 2366.7 | 184.2 | 5.5 | 20 | 18 | 15 | 10 |
| 2 | Metal | 2.0 | 16.0 | Resolver | 5214.7 | 2178.4 | 180.2 | 6.9 | 20 | 18 | 15 | 10 |

**Table 34. 2.0 mg/L ISO 12103-1 A3 medium test dust and 15 ppm free water 2-propanol and Resolver Stanhope Seta AvCount evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | ACM 20 counts | | | | ACM 20 ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 2.0 | 0.8 | None | 4076.0 | 1420.4 | 66.3 | 1.3 | 19 | 18 | 13 | 7 |
| | in-line | 2.0 | 26.5 | None | 30312.4 | 18647.4 | 2711.1 | 29.4 | 22 | 21 | 19 | 12 |
| | Metal | 2.0 | 0.8 | None | 4280.1 | 1543.4 | 47.2 | 0.7 | 19 | 18 | 13 | 7 |
| 11 | Metal | 2.0 | 26.5 | None | 17233.6 | 11588.9 | 657.2 | 2.5 | 21 | 21 | 17 | 8 |
| 17 | Metal | 2.0 | 26.5 | None | 20123.9 | 13742.6 | 819.4 | 2.9 | 22 | 21 | 17 | 9 |
| 11 | Metal | 2.0 | 26.5 | IPA | 3569.7 | 1235.9 | 40.1 | 2.0 | 19 | 17 | 13 | 8 |
| 17 | Metal | 2.0 | 26.5 | Resolver | 3388.3 | 1110.9 | 52.0 | 1.8 | 19 | 17 | 13 | 8 |

**Table 35. 2.0 mg/L ISO 12103-1 A3 medium test dust and 30 ppm free water 2-propanol and Resolver Parker ACM 20 evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | SETA counts | | | | SETA ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 2.0 | 0.8 | None | | | | | | | | |
| | in-line | 2.0 | 26.5 | None | | | | | | | | |
| | Metal | 2.0 | 0.8 | None | 5817.9 | 2518.1 | 201.8 | 6.6 | 20 | 19 | 15 | 10 |
| 11 | Metal | 2.0 | 26.5 | None | 19059.3 | 15070.2 | 4366.9 | 119.3 | 21 | 21 | 19 | 14 |
| 17 | Metal | 2.0 | 26.5 | None | 21381.6 | 17156.8 | 4971.1 | 144.8 | 22 | 21 | 19 | 14 |
| 11 | Metal | 2.0 | 26.5 | IPA | 5430.9 | 2337.5 | 207.9 | 6.5 | 22 | 18 | 15 | 10 |
| 17 | Metal | 2.0 | 26.5 | Resolver | 5261.6 | 2073.9 | 170.9 | 5.2 | 20 | 18 | 15 | 10 |

**Table 36. 2.0 mg/L ISO 12103-1 A3 medium test dust and 30 ppm free water 2-propanol and Resolver Stanhope Seta AvCount evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | ACM 20 counts | | | | ACM 20 ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 0.5 | 0.7 | None | 890.5 | 304.7 | 11.9 | 0.3 | 17 | 15 | 11 | >5 |
| | Metal | 0.5 | 0.7 | None | 832.4 | 264.0 | 7.4 | 0.2 | 17 | 15 | 10 | >5 |
| 25 | Metal | 0.5 | 5.8 | None | 7559.8 | 5154.6 | 250.9 | 1.0 | 20 | 20 | 15 | 7 |
| 21 | Metal | 0.5 | 5.8 | None | 4432.0 | 3019.8 | 211.0 | 0.8 | 19 | 19 | 15 | 7 |
| 25 | Metal | 0.5 | 5.8 | Resolver | 904.5 | 295.3 | 8.1 | 0.5 | 17 | 15 | 10 | >6 |
| 21 | Metal | 0.5 | 5.8 | IPA | 894.1 | 292.5 | 11.1 | 0.4 | 17 | 15 | 11 | >6 |

**Table 37. 0.5 mg/L ISO 12103-1 A3 medium test dust and 10 ppm free water 2-propanol and Resolver Parker ACM 20 evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | SETA counts | | | | SETA ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 0.5 | 0.7 | None | | | | | | | | |
| | Metal | 0.5 | 0.7 | None | 1285.9 | 535.1 | 41.0 | 1.6 | 17 | 16 | 13 | 8 |
| 25 | Metal | 0.5 | 5.8 | None | 7553.1 | 6138.6 | 1735.2 | 48.5 | 20 | 20 | 18 | 13 |
| 21 | Metal | 0.5 | 5.8 | None | 4530.8 | 3478.2 | 1114.5 | 49.0 | 19 | 19 | 17 | 13 |
| 25 | Metal | 0.5 | 5.8 | Resolver | 1450.4 | 668.1 | 69.0 | 4.1 | 18 | 17 | 13 | 9 |
| 21 | Metal | 0.5 | 5.8 | IPA | 1369.4 | 587.8 | 40.1 | 1.0 | 18 | 16 | 12 | 7 |

**Table 38. 0.5 mg/L ISO 12103-1 A3 medium test dust and 10 ppm free water 2-propanol and Resolver Stanhope Seta AvCount evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | ACM 20 counts | | | | ACM 20 ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 0.5 | 0.7 | None | 890.5 | 304.7 | 11.9 | 0.3 | 17 | 15 | 11 | >5 |
| | Metal | 0.5 | 0.7 | None | 832.4 | 264.0 | 7.4 | 0.2 | 17 | 15 | 10 | >5 |
| 22 | Metal | 0.5 | 15.2 | None | 5570.3 | 3897.6 | 260.1 | 1.6 | 20 | 19 | 15 | 8 |
| 4 | Metal | 0.5 | 15.2 | None | 6348.2 | 4478.9 | 282.9 | 1.2 | 20 | 19 | 15 | 7 |
| 22 | Metal | 0.5 | 15.2 | IPA | 957.1 | 300.2 | 8.9 | 1.0 | 17 | 15 | 10 | 7 |
| 4 | Metal | 0.5 | 15.2 | Resolver | 719.9 | 229.6 | 7.3 | 0.4 | 17 | 15 | 10 | >6 |

**Table 39. 0.5 mg/L ISO 12103-1 A3 medium test dust and 15 ppm free water 2-propanol and Resolver Parker ACM 20 evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | SETA counts | | | | SETA ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 0.5 | 0.7 | None | | | | | | | | |
| | Metal | 0.5 | 0.7 | None | 1285.9 | 535.1 | 41.0 | 1.6 | 17 | 16 | 13 | 8 |
| 22 | Metal | 0.5 | 15.2 | None | 5753.5 | 4584.7 | 1504.3 | 59.9 | 20 | 19 | 18 | 13 |
| 4 | Metal | 0.5 | 15.2 | None | 6352.7 | 5182.2 | 1657.5 | 59.9 | 20 | 20 | 18 | 13 |
| 22 | Metal | 0.5 | 15.2 | IPA | 1428.4 | 606.0 | 38.9 | 1.3 | 18 | 16 | 12 | 7 |
| 4 | Metal | 0.5 | 15.2 | Resolver | 1142.9 | 460.3 | 32.9 | 0.6 | 17 | 16 | 12 | 6 |

**Table 40. 0.5 mg/L ISO 12103-1 A3 medium test dust and 15 ppm free water 2-propanol and Resolver Stanhope Seta AvCount evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | ACM 20 counts | | | | ACM 20 ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 0.5 | 0.7 | None | 890.5 | 304.7 | 11.9 | 0.3 | 17 | 15 | 11 | >5 |
| | in-line | 0.5 | 29.0 | None | 30820.4 | 19398.4 | 3078.1 | 35.1 | 22 | 21 | 19 | 12 |
| | Metal | 0.5 | 0.7 | None | 832.4 | 264.0 | 7.4 | 0.2 | 17 | 15 | 10 | >5 |
| 28 | Metal | 0.5 | 29.0 | None | 15711.6 | 11360.6 | 668.6 | 2.2 | 21 | 21 | 17 | 8 |
| 29 | Metal | 0.5 | 29.0 | None | 16297.3 | 11654.9 | 594.0 | 1.5 | 21 | 21 | 16 | 8 |
| 28 | Metal | 0.5 | 29.0 | IPA | 913.4 | 291.4 | 3.8 | 0.1 | 17 | 15 | 9 | >3 |
| 29 | Metal | 0.5 | 29.0 | Resolver | 757.1 | 238.1 | 4.8 | 0.1 | 17 | 15 | 9 | >4 |

**Table 41. 0.5 mg/L ISO 12103-1 A3 medium test dust and 30 ppm free water 2-propanol and Resolver Parker ACM 20 evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | SETA counts | | | | SETA ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 0.5 | 0.7 | None | | | | | | | | |
| | in-line | 0.5 | 29.0 | None | | | | | | | | |
| | Metal | 0.5 | 0.7 | None | 1285.9 | 535.1 | 41.0 | 1.6 | 17 | 16 | 13 | 8 |
| 28 | Metal | 0.5 | 29.0 | None | 16547.5 | 14226.0 | 4424.9 | 116.1 | 21 | 21 | 19 | 14 |
| 29 | Metal | 0.5 | 29.0 | None | 16667.3 | 14275.5 | 4186.1 | 84.6 | 21 | 21 | 19 | 14 |
| 28 | Metal | 0.5 | 29.0 | IPA | 1420.8 | 637.5 | 36.5 | 1.0 | 18 | 16 | 12 | 7 |
| 29 | Metal | 0.5 | 29.0 | Resolver | 1262.8 | 528.7 | 46.6 | 0.9 | 17 | 16 | 13 | 7 |

**Table 42. 0.5 mg/L ISO 12103-1 A3 medium test dust and 30 ppm free water 2-propanol and Resolver Stanhope Seta AvCount evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | ACM 20 counts | | | | ACM 20 ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 0.25 | 0.7 | None | 542.1 | 235.4 | 10.5 | 0.3 | 16 | 15 | 11 | >5 |
| | in-line | 0.25 | 6.6 | None | 13771.6 | 7791.8 | 665.1 | 6.1 | 21 | 20 | 17 | 10 |
| | Metal | 0.25 | 0.7 | None | 411.1 | 248.1 | 22.7 | 1.1 | 16 | 15 | 12 | 7 |
| 24 | Metal | 0.25 | 6.6 | None | 10673.3 | 7230.4 | 415.0 | 3.2 | 21 | 20 | 16 | 9 |
| 27 | Metal | 0.25 | 6.6 | None | 4430.1 | 3265.7 | 236.0 | 2.9 | 19 | 19 | 15 | 9 |
| 24 | Metal | 0.25 | 6.6 | Resolver | 106.6 | 40.8 | 2.6 | 0.9 | 14 | 13 | 9 | 7 |
| 27 | Metal | 0.25 | 6.6 | IPA | 77.1 | 32.0 | 3.3 | 0.5 | 13 | 12 | 9 | >6 |

**Table 43. 0.25 mg/L ISO 12103-1 A3 medium test dust and 10 ppm free water 2-propanol and Resolver Parker ACM 20 evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | SETA counts | | | | SETA ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 0.25 | 0.7 | None | | | | | | | | |
| | in-line | 0.25 | 6.6 | None | | | | | | | | |
| | Metal | 0.25 | 0.7 | None | 250.6 | 146.8 | 30.0 | 0.9 | 15 | 14 | 12 | 7 |
| 24 | Metal | 0.25 | 6.6 | None | 9089.0 | 7812.5 | 2314.4 | 95.6 | 20 | 20 | 18 | 14 |
| 27 | Metal | 0.25 | 6.6 | None | 3599.0 | 3202.6 | 1155.7 | 57.3 | 19 | 19 | 17 | 13 |
| 24 | Metal | 0.25 | 6.6 | Resolver | 135.5 | 63.7 | 3.3 | 0.2 | 14 | 13 | 9 | 4 |
| 27 | Metal | 0.25 | 6.6 | IPA | 93.3 | 39.6 | 2.9 | 0.2 | 14 | 12 | 9 | 5 |

**Table 44. 0.25 mg/L ISO 12103-1 A3 medium test dust and 10 ppm free water 2-propanol and Resolver Stanhope Seta AvCount evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | ACM 20 counts | | | | ACM 20 ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 0.25 | 0.7 | None | 542.1 | 235.4 | 10.5 | 0.3 | 16 | 15 | 11 | >5 |
| | in-line | 0.25 | 12.2 | None | 18370.1 | 10668.9 | 1040.1 | 12.2 | 21 | 21 | 17 | 11 |
| | Metal | 0.25 | 0.7 | None | 411.1 | 248.1 | 22.7 | 1.1 | 16 | 15 | 12 | 7 |
| 26 | Metal | 0.25 | 12.2 | None | 6100.8 | 4376.0 | 185.0 | 0.6 | 20 | 19 | 15 | >6 |
| 27 | Metal | 0.25 | 12.2 | None | 5583.9 | 4049.4 | 175.1 | 0.6 | 20 | 19 | 15 | >6 |
| 26 | Metal | 0.25 | 12.2 | IPA | 62.6 | 20.9 | 2.1 | 0.2 | 13 | 12 | 8 | >5 |
| 27 | Metal | 0.25 | 12.2 | Resolver | 83.0 | 29.6 | 2.4 | 0.6 | 14 | 12 | 8 | >6 |

**Table 45. 0.25 mg/L ISO 12103-1 A3 medium test dust and 15 ppm free water 2-propanol and Resolver Parker ACM 20 evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | SETA counts | | | | SETA ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 0.25 | 0.7 | None | | | | | | | | |
| | in-line | 0.25 | 12.2 | None | | | | | | | | |
| | Metal | 0.25 | 0.7 | None | 250.6 | 146.8 | 30.0 | 0.9 | 15 | 14 | 12 | 7 |
| 26 | Metal | 0.25 | 12.2 | None | 5702.4 | 4992.5 | 1461.3 | 32.7 | 20 | 19 | 18 | 12 |
| 27 | Metal | 0.25 | 12.2 | None | 5985.5 | 5253.9 | 1543.0 | 32.0 | 20 | 20 | 18 | 12 |
| 26 | Metal | 0.25 | 12.2 | IPA | 85.8 | 31.0 | 2.0 | 0.2 | 14 | 12 | 8 | 5 |
| 27 | Metal | 0.25 | 12.2 | Resolver | 106.0 | 43.9 | 3.1 | 0.3 | 14 | 13 | 9 | 5 |

**Table 46. 0.25 mg/L ISO 12103-1 A3 medium test dust and 15 ppm free water 2-propanol and Resolver Stanhope Seta AvCount evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | ACM 20 counts | | | | ACM 20 ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 0.25 | 0.7 | None | 542.1 | 235.4 | 10.5 | 0.3 | 16 | 15 | 11 | >5 |
| | in-line | 0.25 | 28.5 | None | 30074.1 | 18735.7 | 2825.6 | 30.9 | 22 | 21 | 19 | 12 |
| | Metal | 0.25 | 0.7 | None | 411.1 | 248.1 | 22.7 | 1.1 | 16 | 15 | 12 | 7 |
| 24 | Metal | 0.25 | 28.5 | None | 16719.7 | 12258.6 | 900.3 | 15.5 | 21 | 21 | 17 | 11 |
| 18 | Metal | 0.25 | 28.5 | None | 25470.9 | 17853.4 | 767.2 | 1.5 | 22 | 21 | 17 | 8 |
| 24 | Metal | 0.25 | 28.5 | IPA | 142.5 | 51.4 | 2.7 | 1.0 | 14 | 13 | 9 | 7 |
| 18 | Metal | 0.25 | 28.5 | Resolver | 91.9 | 28.4 | 1.7 | 0.3 | 14 | 12 | 8 | >5 |

**Table 47. 0.25 mg/L ISO 12103-1 A3 medium test dust and 30 ppm free water 2-propanol and Resolver Parker ACM 20 evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | SETA counts | | | | SETA ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 0.25 | 0.7 | None | | | | | | | | |
| | in-line | 0.25 | 28.5 | None | | | | | | | | |
| | Metal | 0.25 | 0.7 | None | 250.6 | 146.8 | 30.0 | 0.9 | 15 | 14 | 12 | 7 |
| 24 | Metal | 0.25 | 28.5 | None | 17292.9 | 15185.6 | 5002.1 | 234.0 | 21 | 21 | 20 | 15 |
| 18 | Metal | 0.25 | 28.5 | None | 26237.4 | 22603.1 | 5816.8 | 77.7 | 22 | 22 | 20 | 13 |
| 24 | Metal | 0.25 | 28.5 | IPA | 193.0 | 86.4 | 5.2 | 0.4 | 15 | 14 | 10 | 6 |
| 18 | Metal | 0.25 | 28.5 | Resolver | 130.6 | 37.6 | 3.9 | 0.8 | 14 | 12 | 9 | 7 |

**Table 48. 0.25 mg/L ISO 12103-1 A3 medium test dust and 30 ppm free water 2-propanol and Resolver Stanhope Seta AvCount evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | ACM 20 counts | | | | ACM 20 ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 2.5 | 1.5 | None | 7574.2 | 2202.2 | 13.9 | 0.9 | 20 | 18 | 11 | 7 |
| | in-line | 2.5 | 10.2 | None | 18173.2 | 9091.1 | 724 | 8.4 | 21 | 20 | 17 | 10 |
| | Metal | 2.5 | 1.5 | None | 7625.5 | 1985.3 | 8.1 | 0.3 | 20 | 18 | 10 | >5 |
| 24 | Metal | 2.5 | 10.2 | None | 6599.6 | 1828.6 | 72.3 | 1.7 | 20 | 18 | 13 | 8 |
| 21 | Metal | 2.5 | 10.2 | None | 6289.7 | 1646.9 | 38.9 | 0.8 | 20 | 18 | 12 | 7 |
| 24 | Metal | 2.5 | 10.2 | Resolver | 6912.5 | 1770.5 | 9.3 | 0.4 | 20 | 18 | 10 | >6 |
| 21 | Metal | 2.5 | 10.2 | IPA | 6723.6 | 1754.9 | 10.9 | 0.7 | 20 | 18 | 11 | 7 |

**Table 49. 2.5 mg/L ISO 12103-1 A2 fine test dust and 10 ppm free water 2-propanol and Resolver Parker ACM 20 evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | SETA counts | | | | SETA ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 2.5 | 1.5 | None | | | | | | | | |
| | in-line | 2.5 | 10.2 | None | | | | | | | | |
| | Metal | 2.5 | 1.5 | None | 10631.7 | 4852.4 | 62.0 | 0.9 | 21 | 19 | 13 | 7 |
| 24 | Metal | 2.5 | 10.2 | None | 9400.8 | 4086.0 | 236.6 | 13.6 | 20 | 19 | 15 | 11 |
| 21 | Metal | 2.5 | 10.2 | None | 9011.7 | 3921.5 | 194.6 | 7.5 | 20 | 19 | 15 | 10 |
| 24 | Metal | 2.5 | 10.2 | Resolver | 9854.1 | 4432.4 | 67.2 | 1.3 | 20 | 19 | 13 | 7 |
| 21 | Metal | 2.5 | 10.2 | IPA | 9468.2 | 4288.2 | 72.6 | 1.4 | 20 | 19 | 13 | 7 |

**Table 50. 2.5 mg/L ISO 12103-1 A2 fine test dust and 10 ppm free water 2-propanol and Resolver Stanhope Seta AvCount evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | ACM 20 counts | | | | ACM 20 ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 2.5 | 1.5 | None | 7574.2 | 2202.2 | 13.9 | 0.9 | 20 | 18 | 11 | 7 |
| | in-line | 2.5 | 15.0 | None | 21710.8 | 11666.7 | 1123.6 | 11.1 | 22 | 21 | 17 | 11 |
| | Metal | 2.5 | 1.5 | None | 7625.5 | 1985.3 | 8.1 | 0.3 | 20 | 18 | 10 | >5 |
| 22 | Metal | 2.5 | 15.0 | None | 7312.4 | 2942.0 | 146.8 | 1.1 | 20 | 19 | 14 | 7 |
| 25 | Metal | 2.5 | 15.0 | None | 6465.3 | 2330.4 | 91.3 | 1.2 | 20 | 18 | 14 | 7 |
| 22 | Metal | 2.5 | 15.0 | IPA | 7295.9 | 2112.4 | 12.5 | 0.4 | 20 | 18 | 11 | >6 |
| 25 | Metal | 2.5 | 15.0 | Resolver | 5267.4 | 1196.5 | 8.9 | 0.3 | 20 | 17 | 10 | >5 |

**Table 51. 2.5 mg/L ISO 12103-1 A2 fine test dust and 15 ppm free water 2-propanol and Resolver Parker ACM 20 evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | SETA counts | | | | SETA ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 2.5 | 1.5 | None | | | | | | | | |
| | in-line | 2.5 | 15.0 | None | | | | | | | | |
| | Metal | 2.5 | 1.5 | None | 10631.7 | 4852.4 | 62.0 | 0.9 | 21 | 19 | 13 | 7 |
| 22 | Metal | 2.5 | 15.0 | None | 9704.1 | 5023.5 | 986.2 | 22.3 | 20 | 20 | 17 | 12 |
| 25 | Metal | 2.5 | 15.0 | None | 8753.2 | 4195.8 | 630.7 | 14.3 | 20 | 19 | 16 | 11 |
| 22 | Metal | 2.5 | 15.0 | IPA | 10055.5 | 4843.7 | 107.2 | 0.9 | 21 | 19 | 14 | 7 |
| 25 | Metal | 2.5 | 15.0 | Resolver | 7813.0 | 3167.9 | 59.3 | 1.7 | 20 | 19 | 13 | 8 |

**Table 52. 2.5 mg/L ISO 12103-1 A2 fine test dust and 15 ppm free water 2-propanol and Resolver Stanhope Seta AvCount evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | ACM 20 counts | | | | ACM 20 ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 2.5 | 1.5 | None | 7574.2 | 2202.2 | 13.9 | 0.9 | 20 | 18 | 11 | 7 |
| | in-line | 2.5 | 32.0 | None | 30866.8 | 18838.6 | 2832.4 | 33.6 | 22 | 21 | 19 | 12 |
| | Metal | 2.5 | 1.5 | None | 7625.5 | 1985.3 | 8.1 | 0.3 | 20 | 18 | 10 | >5 |
| 23 | Metal | 2.5 | 32.0 | None | 16981.1 | 11147.5 | 1025.1 | 16.6 | 21 | 21 | 17 | 11 |
| 26 | Metal | 2.5 | 32.0 | None | 17462.7 | 11488.1 | 1032.6 | 18.2 | 21 | 21 | 17 | 11 |
| 23 | Metal | 2.5 | 32.0 | IPA | 7525.2 | 2211.0 | 15.4 | 0.4 | 20 | 18 | 11 | >6 |
| 26 | Metal | 2.5 | 32.0 | Resolver | 5953.4 | 1545.4 | 15.6 | 0.6 | 20 | 18 | 11 | >6 |

**Table 53. 2.5 mg/L ISO 12103-1 A2 fine test dust and 30 ppm free water 2-propanol and Resolver Parker ACM 20 evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | SETA counts | | | | SETA ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 2.5 | 1.5 | None | | | | | | | | |
| | in-line | 2.5 | 32.0 | None | | | | | | | | |
| | Metal | 2.5 | 1.5 | None | 10631.7 | 4852.4 | 62.0 | 0.9 | 21 | 19 | 13 | 7 |
| 23 | Metal | 2.5 | 32.0 | None | 19834.8 | 14976.8 | 4658.3 | 210.3 | 21 | 21 | 19 | 15 |
| 26 | Metal | 2.5 | 32.0 | None | 19599.1 | 14758.9 | 4707.0 | 213.1 | 21 | 21 | 19 | 15 |
| 23 | Metal | 2.5 | 32.0 | IPA | 10377.2 | 4988.2 | 132.6 | 1.5 | 21 | 19 | 14 | 8 |
| 26 | Metal | 2.5 | 32.0 | Resolver | 8632.9 | 3765.7 | 98.7 | 2.7 | 20 | 19 | 14 | 9 |

**Table 54. 2.5 mg/L ISO 12103-1 A2 fine test dust and 30 ppm free water 2-propanol and Resolver Stanhope Seta AvCount evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | ACM 20 counts | | | | ACM 20 ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 2.0 | 1.6 | None | 6005.8 | 1454 | 46.8 | 2.4 | 20 | 18 | 13 | 8 |
| | in-line | 2.0 | 9.8 | None | 16310.7 | 7972.3 | 648.1 | 6.1 | 21 | 20 | 17 | 10 |
| | Metal | 2.0 | 1.6 | None | 5896.8 | 1377.7 | 27.6 | 0.7 | 20 | 18 | 12 | 7 |
| 18 | Metal | 2.0 | 9.8 | None | 5647.2 | 1606.2 | 93.6 | 2.3 | 20 | 18 | 14 | 8 |
| 20 | Metal | 2.0 | 9.8 | None | 5983.3 | 1826.1 | 84.3 | 1.6 | 20 | 18 | 14 | 8 |
| 18 | Metal | 2.0 | 9.8 | IPA | 5556.1 | 1312.4 | 44.4 | 0.9 | 20 | 18 | 13 | 7 |
| 20 | Metal | 2.0 | 9.8 | Resolver | 4476.4 | 828.0 | 9.7 | 0.3 | 19 | 17 | 10 | >5 |

**Table 55. 2.0 mg/L ISO 12103-1 A2 fine test dust and 10 ppm free water 2-propanol and Resolver Parker ACM 20 evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | SETA counts | | | | SETA ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 2.0 | 1.6 | None | | | | | | | | |
| | in-line | 2.0 | 9.8 | None | | | | | | | | |
| | Metal | 2.0 | 1.6 | None | 9891.4 | 3068.4 | 124.2 | 5.2 | 20 | 19 | 14 | 10 |
| 18 | Metal | 2.0 | 9.8 | None | 9321.5 | 3037.7 | 341.4 | 22.2 | 20 | 19 | 16 | 12 |
| 20 | Metal | 2.0 | 9.8 | None | 9657.0 | 3413.2 | 367.2 | 16.9 | 20 | 19 | 16 | 11 |
| 18 | Metal | 2.0 | 9.8 | IPA | 9294.0 | 2811.6 | 135.2 | 3.4 | 20 | 19 | 14 | 9 |
| 20 | Metal | 2.0 | 9.8 | Resolver | 8277.9 | 2273.2 | 54.0 | 1.0 | 20 | 18 | 13 | 7 |

**Table 56. 2.0 mg/L ISO 12103-1 A2 fine test dust and 10 ppm free water 2-propanol and Resolver Stanhope Seta AvCount evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | ACM 20 counts | | | | ACM 20 ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 2.0 | 1.6 | None | 6005.8 | 1454 | 46.8 | 2.4 | 20 | 18 | 13 | 8 |
| | in-line | 2.0 | 14.4 | None | 20634.4 | 10983.4 | 1085 | 13.7 | 22 | 21 | 17 | 11 |
| | Metal | 2.0 | 1.6 | None | 5896.8 | 1377.7 | 27.6 | 0.7 | 20 | 18 | 12 | 7 |
| 22 | Metal | 2.0 | 14.4 | None | 7424.1 | 3161.4 | 103.4 | 0.6 | 20 | 19 | 14 | >6 |
| 19 | Metal | 2.0 | 14.4 | None | 7032.9 | 2910.5 | 165.8 | 2.7 | 20 | 19 | 15 | 9 |
| 22 | Metal | 2.0 | 14.4 | Resolver | 4209.7 | 800.6 | 15.2 | 0.6 | 19 | 17 | 11 | >6 |
| 19 | Metal | 2.0 | 14.4 | IPA | 5281.8 | 1243.4 | 29.6 | 0.9 | 20 | 17 | 12 | 7 |

**Table 57. 2.0 mg/L ISO 12103-1 A2 fine test dust and 15 ppm free water 2-propanol and Resolver Parker ACM 20 evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | SETA counts | | | | SETA ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 2.0 | 1.6 | None | | | | | | | | |
| | in-line | 2.0 | 14.4 | None | | | | | | | | |
| | Metal | 2.0 | 1.6 | None | 9891.4 | 3068.4 | 124.2 | 5.2 | 20 | 19 | 14 | 10 |
| 22 | Metal | 2.0 | 14.4 | None | 10588.0 | 4907.7 | 877.5 | 11.6 | 21 | 19 | 17 | 11 |
| 19 | Metal | 2.0 | 14.4 | None | 10430.7 | 4543.3 | 902.2 | 31.1 | 21 | 19 | 17 | 12 |
| 22 | Metal | 2.0 | 14.4 | Resolver | 7671.0 | 1984.6 | 43.3 | 2.4 | 20 | 18 | 13 | 8 |
| 19 | Metal | 2.0 | 14.4 | IPA | 8985.7 | 2744.9 | 114.0 | 2.9 | 20 | 19 | 14 | 9 |

**Table 58. 2.0 mg/L ISO 12103-1 A2 fine test dust and 15 ppm free water 2-propanol and Resolver Stanhope Seta AvCount evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | ACM 20 counts | | | | ACM 20 ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 2.0 | 1.6 | None | 6005.8 | 1454 | 46.8 | 2.4 | 20 | 18 | 13 | 8 |
| | in-line | 2.0 | 35.5 | None | 29573.8 | 18218.3 | 2708.5 | 33 | 22 | 21 | 19 | 12 |
| | Metal | 2.0 | 1.6 | None | 5896.8 | 1377.7 | 27.6 | 0.7 | 20 | 18 | 12 | 7 |
| 20 | Metal | 2.0 | 35.5 | None | 13724.1 | 9154.7 | 439.4 | 4.3 | 21 | 20 | 16 | 9 |
| 23 | Metal | 2.0 | 35.5 | None | 7509.9 | 5492.3 | 216.5 | 1.2 | 20 | 20 | 15 | 7 |
| 20 | Metal | 2.0 | 35.5 | IPA | 2072.7 | 544.8 | 27.0 | 1.3 | 18 | 16 | 12 | 7 |
| 23 | Metal | 2.0 | 35.5 | Resolver | 685.6 | 160.8 | 7.9 | 0.8 | 17 | 15 | 10 | 7 |

**Table 59. 2.0 mg/L ISO 12103-1 A2 fine test dust and 30 ppm free water 2-propanol and Resolver Parker ACM 20 evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | SETA counts | | | | SETA ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 2.0 | 1.6 | None | | | | | | | | |
| | in-line | 2.0 | 35.5 | None | | | | | | | | |
| | Metal | 2.0 | 1.6 | None | 9891.4 | 3068.4 | 124.2 | 5.2 | 20 | 19 | 14 | 10 |
| 20 | Metal | 2.0 | 35.5 | None | 17643.6 | 13539.1 | 3442.8 | 63.7 | 21 | 21 | 19 | 13 |
| 23 | Metal | 2.0 | 35.5 | None | 8648.5 | 7156.0 | 2319.2 | 19.1 | 20 | 20 | 18 | 11 |
| 20 | Metal | 2.0 | 35.5 | IPA | 3487.6 | 1123.9 | 76.0 | 2.2 | 19 | 17 | 13 | 8 |
| 23 | Metal | 2.0 | 35.5 | Resolver | 1230.6 | 376.9 | 25.8 | 2.6 | 17 | 16 | 12 | 9 |

**Table 60. 2.0 mg/L ISO 12103-1 A2 fine test dust and 30 ppm free water 2-propanol and Resolver Stanhope Seta AvCount evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | ACM 20 counts | | | | ACM 20 ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 1.0 | 1.0 | None | 3503.0 | 852.5 | 26.5 | 1.0 | 19.0 | 17.0 | 12.0 | 7.0 |
| | in-line | 1.0 | 10.4 | None | 15243.7 | 7858.7 | 665.7 | 7.3 | 21.0 | 20.0 | 17.0 | 10.0 |
| | Metal | 1.0 | 1.0 | None | 4007.4 | 980.2 | 24.9 | 0.9 | 19.0 | 17.0 | 12.0 | 7.0 |
| 1 | Metal | 1.0 | 10.4 | None | 7270.9 | 3618.5 | 264.9 | 2.8 | 20.0 | 19.0 | 15.0 | 9.0 |
| 2 | Metal | 1.0 | 10.4 | None | 5674.7 | 2422.9 | 169.6 | 2.2 | 20.0 | 18.0 | 15.0 | 8.0 |
| 1 | Metal | 1.0 | 10.4 | IPA | 3884.1 | 955.1 | 31.5 | 1.3 | 19.0 | 17.0 | 12.0 | 7.0 |
| 2 | Metal | 1.0 | 10.4 | Resolver | 3447.4 | 807.5 | 22.6 | 0.9 | 19.0 | 17.0 | 12.0 | 7.0 |

**Table 61. 1.0 mg/L ISO 12103-1 A2 fine test dust and 10 ppm free water 2-propanol and Resolver Parker ACM 20 evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | SETA counts | | | | SETA ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 1.0 | 1.0 | None | | | | | | | | |
| | in-line | 1.0 | 10.4 | None | | | | | | | | |
| | Metal | 1.0 | 1.0 | None | 6351.8 | 2011.8 | 53.0 | 1.2 | 20 | 18 | 13 | 7 |
| 1 | Metal | 1.0 | 10.4 | None | 8960.2 | 4703.5 | 1116.1 | 72.1 | 20 | 19 | 17 | 13 |
| 2 | Metal | 1.0 | 10.4 | None | 7842.3 | 3809.1 | 750.4 | 55.1 | 20 | 19 | 17 | 13 |
| 1 | Metal | 1.0 | 10.4 | IPA | 6262.8 | 2113.1 | 103.1 | 7.5 | 20 | 18 | 14 | 10 |
| 2 | Metal | 1.0 | 10.4 | Resolver | 5718.3 | 1850.5 | 70.4 | 3.7 | 20 | 18 | 13 | 9 |

**Table 62. 1.0 mg/L ISO 12103-1 A2 fine test dust and 10 ppm free water 2-propanol and Resolver Stanhope Seta AvCount evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | ACM 20 counts | | | | ACM 20 ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 1.0 | 1.0 | None | 3503.0 | 852.5 | 26.5 | 1.0 | 19 | 17 | 12 | 7 |
| | in-line | 1.0 | 14.0 | None | 20095.0 | 11052.8 | 1129.2 | 11.9 | 22 | 21 | 17 | 11 |
| | Metal | 1.0 | 1.0 | None | 4007.4 | 980.2 | 24.9 | 0.9 | 19 | 17 | 12 | 7 |
| 3 | Metal | 1.0 | 14.0 | None | 9900.7 | 5705.8 | 403.1 | 7.1 | 20 | 20 | 16 | 10 |
| 4 | Metal | 1.0 | 14.0 | None | 10334.5 | 6099.3 | 381.5 | 2.7 | 21 | 20 | 16 | 9 |
| 3 | Metal | 1.0 | 14.0 | IPA | 3699.5 | 901.4 | 24.9 | 0.9 | 19 | 17 | 12 | 7 |
| 4 | Metal | 1.0 | 14.0 | Resolver | 3288.4 | 765.9 | 21.9 | 0.8 | 19 | 17 | 12 | 7 |

**Table 63. 1.0 mg/L ISO 12103-1 A2 fine test dust and 15 ppm free water 2-propanol and Resolver Parker ACM 20 evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | SETA counts | | | | SETA ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 1.0 | 1.0 | None | | | | | | | | |
| | in-line | 1.0 | 14.0 | None | | | | | | | | |
| | Metal | 1.0 | 1.0 | None | 6351.8 | 2011.8 | 53.0 | 1.2 | 20 | 18 | 13 | 7 |
| 3 | Metal | 1.0 | 14.0 | None | 12344.2 | 7977.8 | 1975.5 | 119.2 | 21 | 20 | 18 | 14 |
| 4 | Metal | 1.0 | 14.0 | None | 13394.6 | 8863.0 | 2205.8 | 86.6 | 21 | 20 | 18 | 14 |
| 3 | Metal | 1.0 | 14.0 | IPA | 5961.1 | 1989.7 | 90.4 | 4.3 | 20 | 18 | 14 | 9 |
| 4 | Metal | 1.0 | 14.0 | Resolver | 5540.8 | 1770.4 | 76.2 | 3.9 | 20 | 18 | 13 | 9 |

**Table 64. 1.0 mg/L ISO 12103-1 A2 fine test dust and 15 ppm free water 2-propanol and Resolver Stanhope Seta AvCount evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | ACM 20 counts | | | | ACM 20 ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 1.0 | 1.0 | None | 3503.0 | 852.5 | 26.5 | 1.0 | 19 | 17 | 12 | 7 |
| | in-line | 1.0 | 17.0 | None | 28548.0 | 17129.8 | 2419.6 | 31.0 | 22 | 21 | 18 | 12 |
| | Metal | 1.0 | 1.0 | None | 4007.4 | 980.2 | 24.9 | 0.9 | 19 | 17 | 12 | 7 |
| 5 | Metal | 1.0 | 17.0 | None | 18314.5 | 12290.4 | 959.1 | 7.4 | 21 | 21 | 17 | 10 |
| 6 | Metal | 1.0 | 17.0 | None | 25803.7 | 16377.4 | 1221.7 | 11.9 | 22 | 21 | 17 | 11 |
| 5 | Metal | 1.0 | 17.0 | IPA | 3515.7 | 855.7 | 22.9 | 0.5 | 19 | 17 | 12 | >6 |
| 6 | Metal | 1.0 | 17.0 | Resolver | 3304.6 | 775.0 | 16.2 | 0.1 | 19 | 17 | 11 | >3 |

**Table 65. 1.0 mg/L ISO 12103-1 A2 fine test dust and 30 ppm free water 2-propanol and Resolver Parker ACM 20 evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | SETA counts | | | | SETA ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 1.0 | 1.0 | None | | | | | | | | |
| | in-line | 1.0 | 17.0 | None | | | | | | | | |
| | Metal | 1.0 | 1.0 | None | 6351.8 | 2011.8 | 53.0 | 1.2 | 20 | 18 | 13 | 7 |
| 5 | Metal | 1.0 | 17.0 | None | 21564.5 | 16635.8 | 4769.7 | 239.6 | 22 | 21 | 19 | 15 |
| 6 | Metal | 1.0 | 17.0 | None | 31618.0 | 22746.0 | 5642.0 | 283.7 | 22 | 22 | 20 | 15 |
| 5 | Metal | 1.0 | 17.0 | IPA | 5618.8 | 1926.3 | 98.4 | 4.1 | 20 | 18 | 14 | 9 |
| 6 | Metal | 1.0 | 17.0 | Resolver | 5530.8 | 1847.0 | 89.4 | 3.5 | 20 | 18 | 14 | 9 |

**Table 66. 1.0 mg/L ISO 12103-1 A2 fine test dust and 30 ppm free water 2-propanol and Resolver Stanhope Seta AvCount evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | ACM 20 counts | | | | ACM 20 ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 0.5 | 1.2 | None | 2073.6 | 507.6 | 16.3 | 0.9 | 18 | 16 | 11 | 7 |
| | in-line | 0.5 | 5.0 | None | 8256.1 | 4039.5 | 307.9 | 2.8 | 20 | 19 | 15 | 9 |
| | Metal | 0.5 | 1.2 | None | 2153.8 | 512.7 | 11.7 | 0.1 | 18 | 16 | 11 | >4 |
| 8 | Metal | 0.5 | 5.0 | None | 2586.3 | 899.4 | 63.6 | 1.8 | 19 | 17 | 13 | 8 |
| 7 | Metal | 0.5 | 5.0 | None | 2579.0 | 898.6 | 60.8 | 1.1 | 19 | 17 | 13 | 7 |
| 8 | Metal | 0.5 | 5.0 | Resolver | 2045.5 | 485.4 | 14.9 | 0.6 | 18 | 16 | 11 | >6 |
| 7 | Metal | 0.5 | 5.0 | IPA | 2131.1 | 505.4 | 15.3 | 0.4 | 18 | 16 | 11 | >6 |

**Table 67. 0.50 mg/L ISO 12103-1 A2 fine test dust and 5 ppm free water 2-propanol and Resolver Parker ACM 20 evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | SETA counts | | | | SETA ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 0.5 | 1.2 | None | | | | | | | | |
| | in-line | 0.5 | 5.0 | None | | | | | | | | |
| | Metal | 0.5 | 1.2 | None | 3511.5 | 1181.9 | 47.9 | 3.2 | 19 | 17 | 13 | 9 |
| 8 | Metal | 0.5 | 5.0 | None | 3881.6 | 1555.7 | 243.2 | 19.7 | 19 | 18 | 15 | 11 |
| 7 | Metal | 0.5 | 5.0 | None | 3979.2 | 1611.9 | 238.5 | 17.1 | 19 | 18 | 15 | 11 |
| 8 | Metal | 0.5 | 5.0 | Resolver | 3426.5 | 1107.4 | 50.1 | 1.9 | 19 | 17 | 13 | 8 |
| 7 | Metal | 0.5 | 5.0 | IPA | 3513.9 | 1139.0 | 47.3 | 1.5 | 19 | 17 | 13 | 8 |

**Table 68. 0.50 mg/L ISO 12103-1 A2 fine test dust and 5 ppm free water 2-propanol and Resolver Stanhope Seta AvCount evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | ACM 20 counts | | | | ACM 20 ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 0.5 | 1.2 | None | 2073.6 | 507.6 | 16.3 | 0.9 | 18 | 16 | 11 | 7 |
| | in-line | 0.5 | 8.8 | None | 15547.6 | 8424.1 | 775.2 | 7.8 | 21 | 20 | 17 | 10 |
| | Metal | 0.5 | 1.2 | None | 2153.8 | 512.7 | 11.7 | 0.1 | 18 | 16 | 11 | >4 |
| 11 | Metal | 0.5 | 8.8 | None | 4083.9 | 2263.5 | 198.9 | 3.2 | 19 | 18 | 15 | 9 |
| 12 | Metal | 0.5 | 8.8 | None | 5212.6 | 2972.1 | 222.9 | 3.3 | 20 | 19 | 15 | 9 |
| 11 | Metal | 0.5 | 8.8 | IPA | 1995.6 | 478.6 | 14.8 | 0.6 | 18 | 16 | 11 | >6 |
| 12 | Metal | 0.5 | 8.8 | Resolver | 1848.1 | 398.7 | 9.1 | 0.3 | 18 | 16 | 10 | >5 |

**Table 69. 0.50 mg/L ISO 12103-1 A2 fine test dust and 10 ppm free water 2-propanol and Resolver Parker ACM 20 evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | SETA counts | | | | SETA ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 0.5 | 1.2 | None | | | | | | | | |
| | in-line | 0.5 | 8.8 | None | | | | | | | | |
| | Metal | 0.5 | 1.2 | None | 3511.5 | 1181.9 | 47.9 | 3.2 | 19 | 17 | 13 | 9 |
| 11 | Metal | 0.5 | 8.8 | None | 5306.7 | 3086.2 | 972.3 | 54.3 | 20 | 19 | 17 | 13 |
| 12 | Metal | 0.5 | 8.8 | None | 6354.6 | 3999.3 | 1140.5 | 57.6 | 20 | 19 | 17 | 13 |
| 11 | Metal | 0.5 | 8.8 | IPA | 3312.8 | 1075.3 | 49.0 | 2.2 | 19 | 17 | 13 | 8 |
| 12 | Metal | 0.5 | 8.8 | Resolver | 3198.8 | 974.8 | 41.0 | 1.2 | 19 | 17 | 13 | 7 |

**Table 70. 0.50 mg/L ISO 12103-1 A2 fine test dust and 10 ppm free water 2-propanol and Resolver Stanhope Seta AvCount evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | ACM 20 counts | | | | ACM 20 ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥25 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 0.5 | 0 | None | 2073.6 | 507.6 | 2.3 | 0.9 | 18 | 16 | 11 | 7 |
| | Metal | 0.5 | 0 | None | 2153.8 | 512.7 | 1.1 | 0.1 | 18 | 16 | 11 | >4 |
| 9 | Metal | 0.5 | 15 | None | 4451.5 | 2612.2 | 22.3 | 3.4 | 19 | 19 | 15 | 9 |
| 10 | Metal | 0.5 | 15 | None | 8604.0 | 5485.1 | 31.3 | 6.1 | 20 | 20 | 16 | 10 |
| 9 | Metal | 0.5 | 15 | IPA | 2027.9 | 467.1 | 1.6 | 0.4 | 18 | 16 | 11 | >6 |
| 10 | Metal | 0.5 | 15 | Resolver | 1820.2 | 404.1 | 1.3 | 0.7 | 18 | 16 | 11 | 7 |

**Table 71. 0.50 mg/L ISO 12103-1 A2 fine test dust and 15 ppm free water 2-propanol and Resolver Parker ACM 20 evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | SETA counts | | | | SETA ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 0.5 | 0 | None | | | | | | | | |
| | Metal | 0.5 | 0 | None | 3511.5 | 1181.9 | 47.9 | 3.2 | 19 | 17 | 13 | 9 |
| 9 | Metal | 0.5 | 15 | None | 5457.0 | 3057.3 | 1109.5 | 59.2 | 20 | 19 | 17 | 13 |
| 10 | Metal | 0.5 | 15 | None | 10157.7 | 7502.5 | 2032.4 | 93.7 | 21 | 20 | 18 | 14 |
| 9 | Metal | 0.5 | 15 | IPA | 3431.5 | 1059.9 | 49.7 | 1.4 | 19 | 17 | 13 | 7 |
| 10 | Metal | 0.5 | 15 | Resolver | 3118.0 | 951.0 | 43.1 | 2.7 | 19 | 17 | 13 | 9 |

**Table 72. 0.50 mg/L ISO 12103-1 A2 fine test dust and 15 ppm free water 2-propanol and Resolver Stanhope Seta AvCount evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | ACM 20 counts | | | | ACM 20 ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 0.25 | 1.0 | None | 1285.6 | 308.4 | 12 | 0.8 | 17 | 15 | 11 | 7 |
| | in-line | 0.25 | 9.0 | None | 14418.7 | 7852.4 | 751.4 | 8.8 | 21 | 20 | 17 | 10 |
| | Metal | 0.25 | 1.0 | None | 1269.5 | 285.1 | 7.9 | 0.1 | 17 | 15 | 10 | >3 |
| 16 | Metal | 0.25 | 9.0 | None | 3397.9 | 1996.0 | 142.0 | 1.1 | 19 | 18 | 14 | 7 |
| 17 | Metal | 0.25 | 9.0 | None | 2447.1 | 1319.3 | 107.5 | 1.1 | 18 | 18 | 14 | 7 |
| 16 | Metal | 0.25 | 9.0 | IPA | 1287.9 | 294.6 | 8.6 | 0.1 | 17 | 15 | 10 | >3 |
| 17 | Metal | 0.25 | 9.0 | Resolver | 1177.1 | 247.1 | 7.6 | 0.5 | 17 | 15 | 10 | >6 |

**Table 73. 0.25 mg/L ISO 12103-1 A2 fine test dust and 10 ppm free water 2-propanol and Resolver Parker ACM 20 evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | SETA counts | | | | SETA ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 0.25 | 1.0 | None | | | | | | | | |
| | in-line | 0.25 | 9.0 | None | | | | | | | | |
| | Metal | 0.25 | 1.0 | None | 2204.0 | 685.6 | 26.8 | 1.1 | 18 | 17 | 12 | 7 |
| 16 | Metal | 0.25 | 9.0 | None | 4115.4 | 2486.3 | 803.4 | 32.9 | 19 | 18 | 17 | 12 |
| 17 | Metal | 0.25 | 9.0 | None | 3134.8 | 1661.0 | 504.1 | 24.7 | 19 | 18 | 16 | 12 |
| 16 | Metal | 0.25 | 9.0 | IPA | 2251.1 | 681.1 | 31.9 | 0.9 | 18 | 17 | 12 | 7 |
| 17 | Metal | 0.25 | 9.0 | Resolver | 2206.6 | 642.7 | 46.7 | 4.6 | 18 | 17 | 13 | 9 |

**Table 74. 0.25 mg/L ISO 12103-1 A2 fine test dust and 10 ppm free water 2-propanol and Resolver Stanhope Seta AvCount evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | ACM 20 counts | | | | ACM 20 ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 0.25 | 1.0 | None | 1285.6 | 308.4 | 12 | 0.8 | 17 | 15 | 11 | 7 |
| | in-line | 0.25 | 17.0 | None | 19461.9 | 11166.2 | 1206.4 | 14.1 | 21 | 21 | 17 | 11 |
| | Metal | 0.25 | 1.0 | None | 1269.5 | 285.1 | 7.9 | 0.1 | 17 | 15 | 10 | >3 |
| 15 | Metal | 0.25 | 17.0 | None | 5700.9 | 3813.7 | 291.3 | 3.2 | 20 | 19 | 15 | 9 |
| 18 | Metal | 0.25 | 17.0 | None | 7311.1 | 4766.1 | 385.9 | 6.1 | 20 | 19 | 16 | 10 |
| 15 | Metal | 0.25 | 17.0 | IPA | 1357.8 | 321.7 | 10.9 | 0.4 | 18 | 16 | 11 | >6 |
| 18 | Metal | 0.25 | 17.0 | Resolver | 1078.6 | 224.6 | 6.4 | 0.5 | 17 | 15 | 10 | >6 |

**Table 75. 0.25 mg/L ISO 12103-1 A2 fine test dust and 15 ppm free water 2-propanol and Resolver Parker ACM 20 evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | SETA counts | | | | SETA ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 0.25 | 1.0 | None | | | | | | | | |
| | in-line | 0.25 | 17.0 | None | | | | | | | | |
| | Metal | 0.25 | 1.0 | None | 2204.0 | 685.6 | 26.8 | 1.1 | 18 | 17 | 12 | 7 |
| 15 | Metal | 0.25 | 17.0 | None | 6385.3 | 4578.3 | 1602.5 | 66.3 | 20 | 19 | 18 | 13 |
| 18 | Metal | 0.25 | 17.0 | None | 9064.6 | 6709.9 | 1947.8 | 93.0 | 20 | 20 | 18 | 14 |
| 15 | Metal | 0.25 | 17.0 | IPA | 2267.1 | 686.4 | 28.3 | 0.3 | 18 | 17 | 12 | 5 |
| 18 | Metal | 0.25 | 17.0 | Resolver | 1875.5 | 523.1 | 13.5 | 0.2 | 18 | 16 | 11 | 4 |

**Table 76. 0.25 mg/L ISO 12103-1 A2 fine test dust and 15 ppm free water 2-propanol and Resolver Stanhope Seta AvCount evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | ACM 20 counts | | | | ACM 20 ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 0.25 | 1.0 | None | 1285.6 | 308.4 | 12 | 0.8 | 17 | 15 | 11 | 7 |
| | in-line | 0.25 | 28.0 | None | 30543.4 | 19192.9 | 3051.4 | 33.8 | 22 | 21 | 19 | 12 |
| | Metal | 0.25 | 1.0 | None | 1269.5 | 285.1 | 7.9 | 0.1 | 17 | 15 | 10 | >3 |
| 17 | Metal | 0.25 | 28.0 | None | 16422.8 | 11720.1 | 834.8 | 12.6 | 21 | 21 | 17 | 11 |
| 19 | Metal | 0.25 | 28.0 | None | 12907.6 | 9121.4 | 409.7 | 2.1 | 21 | 20 | 16 | 8 |
| 17 | Metal | 0.25 | 28.0 | IPA | 1248.1 | 288.1 | 6.9 | 0.2 | 17 | 15 | 10 | 5 |
| 19 | Metal | 0.25 | 28.0 | Resolver | 1057.1 | 231.0 | 14.5 | 3.0 | 17 | 15 | 11 | 9 |

**Table 77. 0.25 mg/L ISO 12103-1 A2 fine test dust and 30 ppm free water 2-propanol and Resolver Parker ACM 20 evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | SETA counts | | | | SETA ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 0.25 | 1.0 | None | | | | | | | | |
| | in-line | 0.25 | 28.0 | None | | | | | | | | |
| | Metal | 0.25 | 1.0 | None | 2204.0 | 685.6 | 26.8 | 1.1 | 18 | 17 | 12 | 7 |
| 17 | Metal | 0.25 | 28.0 | None | 17972.3 | 14862.5 | 4525.5 | 167.9 | 21 | 21 | 19 | 15 |
| 19 | Metal | 0.25 | 28.0 | None | 14125.6 | 11702.6 | 3267.3 | 52.7 | 21 | 21 | 19 | 13 |
| 17 | Metal | 0.25 | 28.0 | IPA | 2134.5 | 662.9 | 25.5 | 0.6 | 18 | 17 | 12 | 6 |
| 19 | Metal | 0.25 | 28.0 | Resolver | 1866.0 | 520.0 | 19.2 | 1.9 | 18 | 16 | 11 | 8 |

**Table 78. 0.25 mg/L ISO 12103-1 A2 fine test dust and 30 ppm free water 2-propanol and Resolver Stanhope Seta AvCount evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | ACM 20 counts | | | | ACM 20 ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 2.5 | 1.2 | None | 15789.2 | 4867.6 | 19.4 | 0.5 | 21 | 19 | 11 | >6 |
| | in-line | 2.5 | 10.2 | None | 23855.1 | 11085.7 | 705.7 | 8.0 | 22 | 21 | 17 | 10 |
| | Metal | 2.5 | 1.2 | None | 16698.1 | 4660.4 | 12.7 | 0.1 | 21 | 19 | 11 | >3 |
| 6 | Metal | 2.5 | 10.2 | None | 18260.8 | 6320.2 | 187.4 | 1.6 | 21 | 20 | 15 | 8 |
| 14 | Metal | 2.5 | 10.2 | None | 18789.3 | 6885.4 | 221.5 | 1.8 | 21 | 20 | 15 | 8 |
| 6 | Metal | 2.5 | 10.2 | Resolver | 16047.1 | 4494.3 | 13.8 | 0.6 | 21 | 19 | 11 | >6 |
| 14 | Metal | 2.5 | 10.2 | IPA | 15677.0 | 4448.4 | 15.8 | 0.1 | 21 | 19 | 11 | >4 |

**Table 79. 2.5 mg/L ISO 12103-1 A1 ultrafine test dust and 10 ppm free water 2-propanol and Resolver Parker ACM 20 evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | SETA counts | | | | SETA ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 2.5 | 1.2 | None | | | | | | | | |
| | in-line | 2.5 | 10.2 | None | | | | | | | | |
| | Metal | 2.5 | 1.2 | None | 22123.2 | 10252.0 | 138.2 | 0.7 | 22 | 21 | 14 | 7 |
| 6 | Metal | 2.5 | 10.2 | None | 23289.0 | 11718.1 | 824.3 | 35.7 | 22 | 21 | 17 | 12 |
| 14 | Metal | 2.5 | 10.2 | None | 23379.0 | 12153.0 | 997.1 | 41.2 | 22 | 21 | 17 | 13 |
| 6 | Metal | 2.5 | 10.2 | Resolver | 21537.2 | 10130.9 | 114.3 | 1.0 | 22 | 21 | 14 | 7 |
| 14 | Metal | 2.5 | 10.2 | IPA | 20750.0 | 9812.0 | 135.8 | 1.5 | 22 | 20 | 14 | 8 |

**Table 80. 2.5 mg/L ISO 12103-1 A1 ultrafine test dust and 10 ppm free water 2-propanol and Resolver Stanhope Seta AvCount evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | ACM 20 counts | | | | ACM 20 ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 2.5 | 1.2 | None | 15789.2 | 4867.6 | 19.4 | 0.5 | 21 | 19 | 11 | >6 |
| | in-line | 2.5 | 12.6 | None | 23835.1 | 11085.7 | 705.7 | 8.0 | 22 | 21 | 17 | 10 |
| | Metal | 2.5 | 1.2 | None | 16698.1 | 4660.4 | 12.7 | 0.1 | 21 | 19 | 11 | >3 |
| 3 | Metal | 2.5 | 12.6 | None | 18960.4 | 7214.0 | 203.1 | 0.8 | 21 | 20 | 15 | 7 |
| 8 | Metal | 2.5 | 12.6 | None | 17786.8 | 6399.5 | 174.7 | 0.7 | 21 | 20 | 15 | 7 |
| 3 | Metal | 2.5 | 12.6 | IPA | 15893.0 | 4470.8 | 16.6 | 0.4 | 21 | 19 | 11 | >6 |
| 8 | Metal | 2.5 | 12.6 | Resolver | 15200.1 | 4117.4 | 10.6 | 0.1 | 21 | 19 | 11 | >3 |

**Table 81. 2.5 mg/L ISO 12103-1 A1 ultrafine test dust and 15 ppm free water 2-propanol and Resolver Parker ACM 20 evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | SETA counts | | | | SETA ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 2.5 | 1.2 | None | | | | | | | | |
| | in-line | 2.5 | 12.6 | None | | | | | | | | |
| | Metal | 2.5 | 1.2 | None | 22123.2 | 10252.0 | 138.2 | 0.7 | 22 | 21 | 14 | 7 |
| 3 | Metal | 2.5 | 12.6 | None | 23683.5 | 12459.4 | 1219.2 | 35.4 | 22 | 21 | 17 | 12 |
| 8 | Metal | 2.5 | 12.6 | None | 22429.7 | 11338.6 | 956.4 | 27.2 | 22 | 21 | 17 | 12 |
| 3 | Metal | 2.5 | 12.6 | IPA | 21195.1 | 9906.6 | 134.8 | 0.8 | 22 | 20 | 14 | 7 |
| 8 | Metal | 2.5 | 12.6 | Resolver | 20635.9 | 9446.7 | 106.1 | 0.8 | 22 | 20 | 14 | 7 |

**Table 82. 2.5 mg/L ISO 12103-1 A1 ultrafine test dust and 15 ppm free water 2-propanol and Resolver Stanhope Seta AvCount evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | ACM 20 counts | | | | ACM 20 ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 2.5 | 1.2 | None | 15789.2 | 4867.6 | 19.4 | 0.5 | 21 | 19 | 11 | >6 |
| | in-line | 2.5 | 32.5 | None | 33383.6 | 19750.2 | 2858.5 | 33.8 | 22 | 21 | 19 | 12 |
| | Metal | 2.5 | 1.2 | None | 16698.1 | 4660.4 | 12.7 | 0.1 | 21 | 19 | 11 | >3 |
| 7 | Metal | 2.5 | 32.5 | None | 26036.8 | 14240.7 | 850.6 | 8.6 | 22 | 21 | 17 | 10 |
| 12 | Metal | 2.5 | 32.5 | None | 25434.9 | 13736.0 | 660.6 | 1.9 | 22 | 21 | 17 | 8 |
| 7 | Metal | 2.5 | 32.5 | IPA | 16493.1 | 4872.2 | 22.1 | 1.0 | 21 | 19 | 12 | 7 |
| 12 | Metal | 2.5 | 32.5 | Resolver | 13612.1 | 3364.7 | 13.0 | 1.3 | 21 | 19 | 11 | 7 |

**Table 83. 2.5 mg/L ISO 12103-1 A1 ultrafine test dust and 30 ppm free water 2-propanol and Resolver Parker ACM 20 evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | SETA counts | | | | SETA ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 2.5 | 1.2 | None | | | | | | | | |
| | in-line | 2.5 | 32.5 | None | | | | | | | | |
| | Metal | 2.5 | 1.2 | None | 22123.2 | 10252.0 | 138.2 | 0.7 | 22 | 21 | 14 | 7 |
| 7 | Metal | 2.5 | 32.5 | None | 29825.3 | 19742.0 | 4729.5 | 139.6 | 22 | 21 | 19 | 14 |
| 12 | Metal | 2.5 | 32.5 | None | 29062.4 | 18995.4 | 4254.5 | 81.6 | 22 | 21 | 19 | 14 |
| 7 | Metal | 2.5 | 32.5 | IPA | 21507.4 | 10235.3 | 174.3 | 1.8 | 22 | 21 | 15 | 8 |
| 12 | Metal | 2.5 | 32.5 | Resolver | 19224.3 | 8286.7 | 92.9 | 1.6 | 21 | 20 | 14 | 8 |

**Table 84. 2.5 mg/L ISO 12103-1 A1 ultrafine test dust and 30 ppm free water 2-propanol and Resolver Stanhope Seta AvCount evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | ACM 20 counts | | | | ACM 20 ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 2.0 | 1.5 | None | 11830.1 | 3650.2 | 14.2 | 0.3 | 21 | 19 | 11 | >5 |
| | in-line | 2.0 | 11.0 | None | 20933.7 | 10076.9 | 677.7 | 6.7 | 22 | 21 | 17 | 10 |
| | Metal | 2.0 | 1.5 | None | 12541.5 | 3309.6 | 14.6 | 0.4 | 21 | 19 | 11 | >6 |
| 26 | Metal | 2.0 | 11.0 | None | 16353.0 | 6855.7 | 309.7 | 2.4 | 21 | 20 | 15 | 8 |
| 27 | Metal | 2.0 | 11.0 | None | 13934.9 | 4945.1 | 197.1 | 2.4 | 21 | 19 | 15 | 8 |
| 26 | Metal | 2.0 | 11.0 | IPA | 12096.6 | 3410.4 | 11.1 | 0.4 | 21 | 19 | 11 | >6 |
| 27 | Metal | 2.0 | 11.0 | Resolver | 11636.6 | 3128.1 | 11.4 | 0.4 | 21 | 19 | 11 | >6 |

**Table 85. 2.0 mg/L ISO 12103-1 A1 ultrafine test dust and 10 ppm free water 2-propanol and Resolver Parker ACM 20 evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | SETA counts | | | | SETA ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 2.0 | 1.5 | None | | | | | | | | |
| | in-line | 2.0 | 11.0 | None | | | | | | | | |
| | Metal | 2.0 | 1.5 | None | 16707.9 | 8088.5 | 94.4 | 1.4 | 21 | 20 | 14 | 8 |
| 26 | Metal | 2.0 | 11.0 | None | 19115.4 | 10649.8 | 1354.0 | 53.6 | 21 | 21 | 18 | 13 |
| 27 | Metal | 2.0 | 11.0 | None | 17623.8 | 8993.5 | 778.8 | 38.3 | 21 | 20 | 17 | 12 |
| 26 | Metal | 2.0 | 11.0 | IPA | 15982.4 | 7869.6 | 98.1 | 0.8 | 21 | 20 | 14 | 7 |
| 27 | Metal | 2.0 | 11.0 | Resolver | 16284.1 | 7893.2 | 94.8 | 1.1 | 21 | 20 | 14 | 7 |

**Table 86. 2.0 mg/L ISO 12103-1 A1 ultrafine test dust and 10 ppm free water 2-propanol and Resolver Stanhope Seta AvCount evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | ACM 20 counts | | | | ACM 20 ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 2.0 | 1.5 | None | 11830.1 | 3650.2 | 14.2 | 0.3 | 21 | 19 | 11 | >5 |
| | in-line | 2.0 | 15.0 | None | 24868.5 | 13072.0 | 1150.9 | 10.3 | 22 | 21 | 17 | 11 |
| | Metal | 2.0 | 1.5 | None | 12541.5 | 3309.6 | 14.6 | 0.4 | 21 | 19 | 11 | >6 |
| 25 | Metal | 2.0 | 15.0 | None | 14713.5 | 6009.6 | 288.2 | 3.0 | 21 | 20 | 15 | 9 |
| 28 | Metal | 2.0 | 15.0 | None | 14662.6 | 6062.9 | 272.2 | 3.1 | 21 | 20 | 15 | 9 |
| 25 | Metal | 2.0 | 15.0 | IPA | 11800.2 | 3328.3 | 11.1 | 0.2 | 21 | 19 | 11 | >5 |
| 28 | Metal | 2.0 | 15.0 | Resolver | 10668.3 | 2825.4 | 11.9 | 0.9 | 21 | 19 | 11 | 7 |

**Table 87. 2.0 mg/L ISO 12103-1 A1 ultrafine test dust and 15 ppm free water 2-propanol and Resolver Parker ACM 20 evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | SETA counts | | | | SETA ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 2.0 | 1.5 | None | | | | | | | | |
| | in-line | 2.0 | 15.0 | None | | | | | | | | |
| | Metal | 2.0 | 1.5 | None | 16707.9 | 8088.5 | 94.4 | 1.4 | 21 | 20 | 14 | 8 |
| 25 | Metal | 2.0 | 15.0 | None | 18297.5 | 10089.5 | 1393.3 | 55.0 | 21 | 21 | 18 | 13 |
| 28 | Metal | 2.0 | 15.0 | None | 17846.2 | 9789.5 | 1292.5 | 47.0 | 21 | 20 | 17 | 13 |
| 25 | Metal | 2.0 | 15.0 | IPA | 15833.4 | 7691.6 | 100.3 | 0.8 | 21 | 20 | 14 | 7 |
| 28 | Metal | 2.0 | 15.0 | Resolver | 15059.0 | 7061.7 | 100.4 | 1.6 | 21 | 20 | 14 | 8 |

**Table 88. 2.0 mg/L ISO 12103-1 A1 ultrafine test dust and 15 ppm free water 2-propanol and Resolver Stanhope Seta AvCount evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | ACM 20 counts | | | | ACM 20 ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 2.0 | 1.5 | None | 11830.1 | 3650.2 | 14.2 | 0.3 | 21 | 19 | 11 | >5 |
| | in-line | 2.0 | 29.5 | None | 32451.7 | 19610.9 | 2896.6 | 35.1 | 22 | 21 | 19 | 12 |
| | Metal | 2.0 | 1.5 | None | 12541.5 | 3309.6 | 14.6 | 0.4 | 21 | 19 | 11 | >6 |
| 30 | Metal | 2.0 | 29.5 | None | 19289.3 | 10688.1 | 735.2 | 10.6 | 21 | 21 | 17 | 11 |
| 29 | Metal | 2.0 | 29.5 | None | 25180.4 | 15654.7 | 1249.8 | 14.4 | 22 | 21 | 17 | 11 |
| 30 | Metal | 2.0 | 29.5 | IPA | 11213.9 | 3127.2 | 13.6 | 0.9 | 21 | 19 | 11 | 7 |
| 29 | Metal | 2.0 | 29.5 | Resolver | 10677.2 | 2923.5 | 23.0 | 2.4 | 21 | 19 | 12 | 8 |

**Table 89. 2.0 mg/L ISO 12103-1 A1 ultrafine test dust and 30 ppm free water 2-propanol and Resolver Parker ACM 20 evaluation.**

| Sample | Bottle Type | Dust Concentration (mg/L) | Water (ppm) | Additive | SETA counts | | | | SETA ISO codes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ≥4 um | ≥6 um | ≥14 um | ≥30 um | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
| | in-line | 2.0 | 1.5 | None | | | | | | | | |
| | in-line | 2.0 | 29.5 | None | | | | | | | | |
| | Metal | 2.0 | 1.5 | None | 16707.9 | 8088.5 | 94.4 | 1.4 | 21 | 20 | 14 | 8 |
| 30 | Metal | 2.0 | 29.5 | None | 21831.1 | 14163.7 | 3574.7 | 126.5 | 22 | 21 | 19 | 14 |
| 29 | Metal | 2.0 | 29.5 | None | 28204.3 | 20322.5 | 5702.5 | 225.5 | 22 | 22 | 20 | 15 |
| 30 | Metal | 2.0 | 29.5 | IPA | 15147.7 | 7327.4 | 126.1 | 1.3 | 21 | 20 | 14 | 7 |
| 29 | Metal | 2.0 | 29.5 | Resolver | 14527.6 | 6760.4 | 126.6 | 2.5 | 21 | 20 | 14 | 9 |

**Table 90. 2.0 mg/L ISO 12103-1 A1 ultrafine test dust and 30 ppm free water 2-propanol and Resolver Stanhope Seta AvCount evaluation.**

## Conclusions

Sample container material was shown to have an impact on particle counting results with glass bottles seeming to eliminate all (or nearly all) effects of free water on the test results. At given times the particle counts taken from the HDPE bottles were peculiar in that samples taken concurrently produced erratic results. It produced results that were at times lower than expected based on on-line testing, and sometimes falling below the baseline bottle measurements taken without free water present. Further troubling was the addition of the additives, at times increasing the particle count measurement due to the additives not partitioning to the fuel phase but rather remaining in large additive droplets. The use of tin plate steel F-style cans solved these problems and, with a few exceptions, showed that the use of the additives eliminated the effects of water droplets on particle counter readings.

Bottle samples with free water where lower than online particle counts by an average of 74% in glass bottles, 69% in HDPE bottles, and 50% in tin plate steel F-style cans. The particle counts dropped with an increase in time after sampling as the water droplets self-coalesced, and or were dissolved into the fuel, or attached to the sample container walls.

The effect of the additive's ability to remove the free water from the particle count measurement was also affected by the container material. The total particle counts (≥4µm cumulative counts) for the samples in the glass containers fell within an average of 8% of the baseline measurements for the Resolver additive and 6% for the 2-propanol additive. For the HDPE bottles the particle counts varied an average of 35% from the baseline measurements with the 2-propanol additive and 24% with the Resolver additive mixed in. With the tin plate cans, the particle counts with the 2-propanol varied from the baseline by an average of 7% while the Resolver additive varied by an average of 15%. Table 91 details the sample particle counts proximity to the baseline measurements, broken down by sample container material and additive type, utilizing the instrument repeatability as the margin of error. A closer examination of this data indicates that the Resolver additive treated fuels comparison to baseline falls outside the repeatability of the instrumentation due to the particle counts falling lower than the 2-propanol additive treated fuels in most cases. It should be noted that the baseline measurements contained free water so lower particle count data, falling below the bassline measurements, was expected.

| Container | Additive | Total samples | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
|---|---|---|---|---|---|---|
| Metal | 2-propanol | 33 | 28 | 28 | 30 | 33 |
| | Resolver | 33 | 16 | 18 | 28 | 32 |
| HDPE | 2-propanol | 12 | 2 | 4 | 12 | 11 |
| | Resolver | 13 | 5 | 11 | 13 | 12 |

**Table 91. Treated sample data points that had baseline measurements fall within their repeatability**

| Container | Total samples | ≥4 um | ≥6 um | ≥14 um | ≥30 um |
|---|---|---|---|---|---|
| Metal | 33 | 29 | 29 | 24 | 18 |
| HDPE | 11 | 5 | 5 | 5 | 4 |

**Table 92. Resolver data points lower than 2-propanol**

The application of both the Resolver additive and the 2-propanol co-solvent have demonstrated the ability to reduce or eliminate the effect free water on light obscuration particle count data. Any particle count measurements that exceeds established limits, particularly in the 6µm, 14µm, or 30µm channels should be retested utilizing the Resolver additive or 2-propanol co-solvent to eliminate the effect of free water on the particle count data. Sample container type (material) should be considered when performing particle counts.

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**List of Symbols, Abbreviations, and Acronyms**

| | |
|---|---|
| μm | Micrometer |
| ASTM | ASTM International |
| EI | Energy Institute |
| HDPE | High Density Polyethylene |
| IPA | Isopropyl Alcohol (2-propanol) |
| ISO | International Organization for Standardization |
| mg/L | Milligrams per Liter |
| MIL | Military |
| POL | Petroleum Oil Lubricants |
| ppm | Parts Per Million |
| STD | Standard |
| TARDEC | Tank Automotive Research Development and Engineering Center |
| U.S. | United States |